DISSERTATION

ASSESSING COLLEGE STUDENTS' SUSTAINABILITY LITERACY: THE DEVELOPMENT, USE, AND ANALYSIS OF AN ASSESSMENT TOOL

Submitted by

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In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Fall 2017

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ABSTRACT

ASSESSING COLLEGE STUDENTS' SUSTAINABILITY LITERACY: THE DEVELOPMENT, USE, AND ANALYSIS OF AN ASSESSMENT TOOL

This dissertation discusses the development, use, and analysis of a knowledge-based multiple-choice sustainability literacy assessment tool used in Spring 2016 at Colorado State University (CSU). CSU is a leading institution of sustainability education and research, and a participant of the Sustainability Tracking, Assessment, and Rating System (STARS). A component of STARS includes assessing college students' sustainability literacy. The study, and the sustainability literacy assessment tool described, were designed within the framework of the Triple Bottom Line (TBL). Data sets were collected and analyzed from a sustainability literacy assessment given in Spring 2016. Findings from the study show students performed highest in environmental sustainability literacy and lowest in social sustainability literacy, two of three dimensions of the TBL. Additionally, four focus groups of students were held at CSU in Spring 2017. The focus groups informed the study of how students' defined the concept of sustainability and the three dimensions of the TBL. Findings from the focus groups indicated the design of the assessment tool did not garner meaningful results. The assessment tool was designed with knowledge-based multiple-choice questions, which did not accurately assess sustainability literacy, according to its definition. Recommendations for redesigning the assessment tool include designing questions that assess students' ability to apply systems-thinking and conduct critical thinking and problem-solving. Sustainability educators should seek to encourage transformational learning when teaching sustainability education. With the recommendations for

assessment redesign, the researcher also includes suggestions of unique ways institutions of higher education can assess students' sustainability literacy.

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CHAPTER ONE: INTRODUCTION

Before the mid-1980s little was written about sustainability. However, after the mid-1980s the use of the word sustainability increased in publications, conferences, and national discussions. A search on Google Books found 857 published books mentioned the word sustainability after the mid-1980s (Google Books, n.d.). Beyond publications, numerous corporations, national and local governments, and specific to the study, *institutions of higher education* (IHE) have adopted the use of the word sustainability. However, what does the word sustainability mean? Answering this question involves some complexity. In general, the term, which is a noun, has been used in relation to the natural world. The definition of sustainability is "the ability to be sustained, supported, upheld, or confirmed" and specific to the natural world, "the quality of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological balance" (Sustainability, 2017). Historically, the word sustainability dates back to the 18th century when it first appeared in a German forestry handbook in 1713 (Le Grange, 2011; Rack, 2014). Sustainability has grown to address more than the environment; today it is seen as a "complex concept" (What is Sustainability?, n.d., para. 1), which "must apply to many ecological and social situations" (Allen & Hoekstra, 1993, p. 99). The *concept of sustainability* now includes social and economic dimensions.

Grouping economic, environmental, and social dimensions of sustainability is referred to as the *Triple Bottom Line* (TBL). The TBL is a framework originally developed by John Elkington in the 1990s as a "business approach that creates long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental, and social developments" (Corporate Sustainability, n.d., para. 1). Seeing the applicability of the TBL to

framing the concept of sustainability, many within higher education adopted the TBL approach (Hammer, 2015; Miller, 2015; Peralta Alvarez, Barcena & Gonzalez, 2016; Stenzel, 2010).

The TBL is used at Colorado State University (CSU), where the study was conducted. Specifically, CSU's School of Global Environmental Sustainability (SoGES) uses the TBL to explain the mission of the School. SoGES is an interdisciplinary unit promoting research and education dealing with complex environmental, economic, and societal issues of sustainability (About the School of Global Environmental Sustainability, n.d.). The TBL framework used by SoGES and other IHE is illustrated in Figure 1.

Figure 1. The Triple Bottom Line (Use Wine., n.d.).

Background

The modern concept of sustainability originated in 1987 by the World Commission of Environment and Development (WCED), a group comprised of experts formed by the United Nations (UN) in 1983. The WCED is often credited for renewing the call for sustainable development (Basiago, 1999), meaning "a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development; and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations" (World Commission on Environment and Development, 1987, p.

43). The WCED described the concept of sustainability in its renowned report "*Our Common Future*", also known as the "Brundtland Report". The WCED was chaired by former Norwegian Prime Minister Dr. Gro Harlem Brundtland.

After the Brundtland Report was published, many educators began to think about sustainability in a new way and looked to the Report as a framework to follow.

> The idea of sustainability re-emerged with a broader definition than simply caring for the environment and conserving natural resources, essentially becoming an umbrella philosophy encompassing the economy, social life, culture, politics, and social order through educational awareness and the ability to effectively manage and plan for sustainable change (McFarlane & Ogazon, 2011, p. 82).

The Brundtland Report is significant because it is the first major world report to emphasize the importance of sustainable development and highlight significant global challenges. It was the catalyst in bringing together over 30,000 participants, including 108 heads of state, to the UN Conference on Environment and Development, informally known as the Earth Summit, in Rio de Janeiro, Brazil in 1992 (Framing Sustainable Development, 2007). The Earth Summit influenced subsequent international conferences, as the more recent UN Climate Change Conference, which took place in 2015 and the International Conference on Sustainable Development in 2016. The conferences addressed various topics related to the concept of sustainability, such as human rights, human population dynamics, social development, women and human settlements, and environmentally sustainable development.

Growth of Sustainability-Focused Organizations

With the adoption of the concept of sustainability by corporations, national and local governments, and IHE, many sustainability organizations have also been established. These organizations place their focus entirely around the concept of sustainability. In the United States one example is the American Sustainable Business Council located in Washington, DC, and

globally an example is the International Organization for Sustainable Development, with offices in the United States, Belgium, Germany, Central African Republic, Pakistan, and headquarters in The Gambia. Significant to this study, is the Association for the Advancement of Sustainability in Higher Education (AASHE), located in Philadelphia, PA.

AASHE is a non-profit 501(c)(3) membership organization that formed in January 2006 after the success of a sustainability conference held in 2004 by the Education for Sustainability Western Network (EFS West). The popularity of EFS West, which had a mission "to make sustainability a foundation of all aspects of higher education in the western U.S. and Canada" (EFS West, n.d., para. 1), led to the creation of AASHE. Attendees of the 2004 EFS West conference saw the need to expand their mission around the globe, thus they founded AASHE.

AASHE has led the charge for integrating the concept of sustainability throughout IHE around the globe. Important to this study, AASHE has emphasized the importance of assessing students' sustainability literacy (Assessing Sustainability Literacy, 2012) in the context of the institution.

AASHE provides a platform for sustainability education. The organization's mission is to empower "higher education faculty, administrators, staff and students to be effective change agents and drivers of sustainability innovation" (About AASHE, n.d.). AASHE acts as a networking "hub" for IHE to share ideas and learn from one another. The organization does this through various means, such as an annual conference and expo, its website, and other events and literature, which includes reports and research.

The Sustainability Education Movement

The sustainability movement, as some call it (Bartlett & Chase, 2013, p. xi), gained momentum in higher education with the creation of AASHE in the mid-2000s. Advocates of

sustainability education believe IHE should play "a critical role in assisting change towards a sustainable present and future within our society" (Junyent & Geli de Ciurana, 2008, p. 764). Since 2006, the concept of sustainability has increasingly been considered and included in higher education administrative decision-making, curriculum planning and development, campus activities and events, and scientific research. Visit any college or university campus and walk around and most likely you will see artifacts of sustainability such as bottle refilling stations, compost stations, and recycling bins. More importantly, because the number of academic disciplines that have incorporated the concept of sustainability have multiplied over the past 30 years (Slaper & Hall, 2011, p. 4), a growingly diverse population of students have the opportunity to study sustainability-related topics.

Sustainability education is also finding acceptance in K-12 education (Haas & Ashman, 2014; Warner, 2015). For example, the U.S. state of Washington implemented environmental sustainability education standards for K-12 students (Dorn, Kanikeberg, & Burke, 2014). Many K-12 school districts throughout the United States are adopting the concept of sustainability in both decision-making and curriculum design. Chapman (2014) investigated sustainability education in public schools in Colorado, Florida, Hawaii, Kansas, Kentucky, Maryland, Massachusetts, Missouri, Oregon, Virginia, Washington, and Wisconsin and found "many public schools are working to make environmental sustainability a priority" (p. 3). The study identified various stakeholders having interest in sustainability education, including administrators, faculty, and students who are motivated by their concern for the environment (Chapman, 2014, p. 3).

In higher education, we see sustainability education institutionalized. Numerous IHE have developed sustainability offices (e.g., Bard College, NY, US), centers (e.g., Georgia Southern University, GA, US), institutes (e.g., Pennsylvania State University, PA, US),

departments (e.g., Bowling Green State University, OH, US), schools (e.g., University of Saskatchewan, Saskatchewan, CDN), and colleges (e.g., University of South Florida, FL, US). These various units of sustainability are unique because they place considerable attention on addressing environmental and societal problems from an interdisciplinary approach, encouraging faculty to work with others outside of their traditional disciplines (Bartlett & Chase, 2013, p. 1).

Sustainability, Tracking Assessment and Rating System

To assist IHE in assessing their sustainability performance, and specifically their students' sustainability literacy, AASHE developed the Sustainability, Tracking, Assessment & Rating System (STARS). STARS, which was first piloted by AASHE in 2009 as "a voluntary, self-reporting framework for recognizing and gauging relative progress toward sustainability for colleges and universities" (STARS Overview, n.d., para. 1). STARS is designed to:

- Provide a framework for understanding sustainability in all sectors of higher education.
- Enable meaningful comparisons over time and across institutions using a common set of measurements developed with broad participation from the international campus sustainability community.
- Create incentives for continual improvement toward sustainability.
- Facilitate information sharing about higher education sustainability practices and performance.
- Build a stronger, more diverse campus sustainability community (STARS Overview, n.d.).

STARS participants voluntarily pursue credits that lead to a STARS rating of either bronze, silver, gold, or the highest rating, platinum (Figure 2). Ratings are determined based on how an

IHE scores attained on a IHE prepared report. Scores are determined by the percentage of points an institution earns across four categories:

1) Academics (AC)
2) Engagement (EN)
3) Operations (OP)
4) Planning & Administration (PA)

Figure 2. STARS Recognition.

An example provided in the STARS 2.1 Technical Manual (2017) explains if an IHE earned thirty percent of the possible points across categories, their score would be thirty, meaning the IHE would earn a STARS rating of bronze. The minimum scores required to earn one of the four STARS ratings are summarized in Figure 3.

STARS Rating	Minimum score required
Bronze	25
Silver	45
Gold	65
Platinum	85

Figure 3. STARS Minimum Scores for Ratings (STARS 2.1 Technical Manual, 2017, p. 11).

Some IHE may decide to participate in STARS but not make their scores public; these institutions are considered "reporter" institutions and do not receive a STARS rating (STARS, n.d.). Participating IHE have the opportunity to earn bonus points in the category of Innovation

and Leadership for new and path-breaking practices and performances that are not covered in the other four categories. Each category includes subcategories that are worth a value of points. The point values are shown under their corresponding category and subcategory in Figure 4 (STARS Technical Manual, 2017, pp. 18-19).

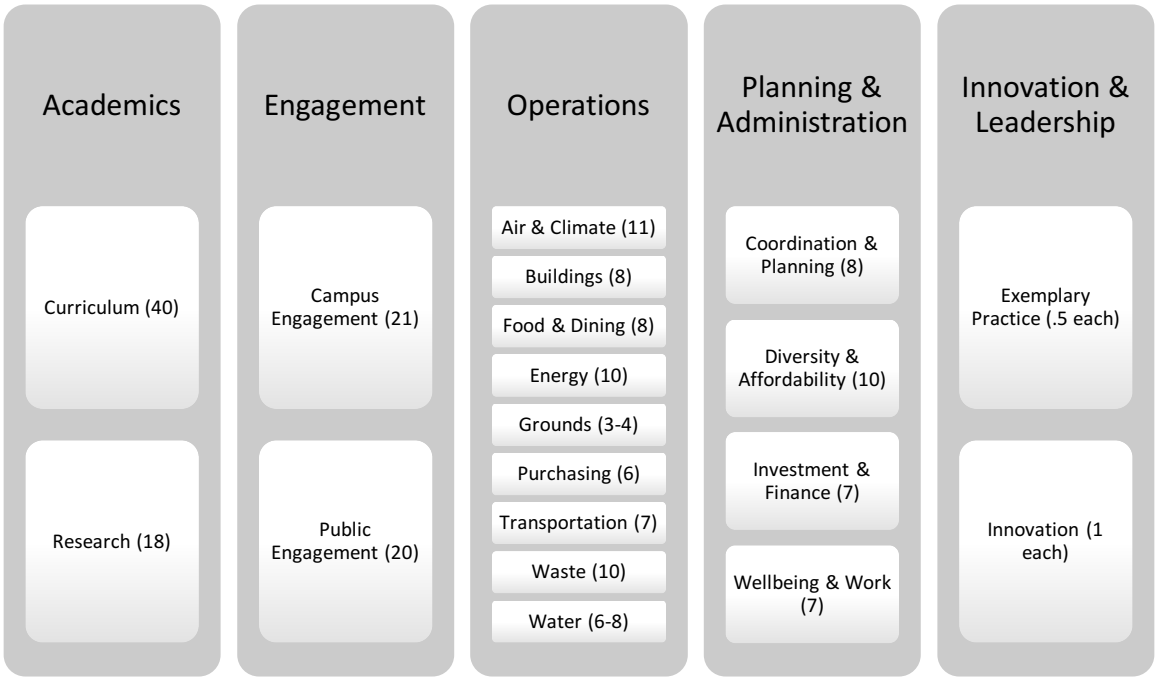

Figure 4. Five Categories of STARS.

Sustainability Literacy Assessment

Under the Academics category, participating IHE can earn four points for assessing students' sustainability literacy. This is titled AC 6: Sustainability Literacy Assessment (STARS 2.1 Technical Manual, 2017, p. 18). IHE are allowed to select or develop an assessment tool of their choice, however, the assessment tool must include questions pertaining to knowledge of sustainability (STARS Technical Manual, 2016, p. 54). IHE can include questions relating to behavior, beliefs, and values. The purpose of the sustainability literacy assessment is to "help institutions evaluate the success of their sustainability education initiatives and develop insight

into how these initiatives could be improved" (STARS Technical Manual, 2014, p. 43). The sustainability literacy assessment used at CSU in Spring 2016 is the tool discussed in the study.

Sustainability at Colorado State University

CSU, located in Fort Collins, Colorado promotes a commitment to sustainability and brands itself as a sustainability-focused institution. CSU was a STARS Charter Participant, one of 66 original institutions to participate in the STARS Pilot in 2009. Additionally, CSU is the first institution to reach STARS ratings of Gold, in 2011, and Platinum in 2015 (Colorado State University Reports, n.d.). CSU has been included on the Princeton Review's Green College Honor Roll (2016), was named the # 1 "Greenest College" by bestcolleges.com (2015), and ranked fourth as a Sierra Club "Top Ten Coolest School" (The Top 10 America's Greenest Universities, 2015).

CSU, as a land grant university, has a long history of addressing environmental issues in its education and research, however specifically addressing the concept of sustainability is its School of Global Environmental Sustainability. The University established SoGES in 2008 to address global sustainability challenges and act as an interdisciplinary unit. Uniquely, instead of being a part of a college, SoGES works directly under the Provost's Office, encouraging an interdisciplinary approach to sustainability education and research. The University has eight college units, which include Agriculture Sciences (CAS), Business (COB), Engineering (ENGRG), Health and Human Sciences (CHHS), Liberal Arts (CLA), Natural Resources (CNR), Natural Sciences (CNS), and Veterinary Medicine and Biomedical Sciences (CVMBS). However, CSU claims to expose students to a diverse sustainability education across all colleges. On its website the University advertises it offers 962 sustainability-related courses, with sustainability-related majors and minors housed in each of its eight colleges (Green Colostate,

n.d.). SoGES endorses 56 courses as being those with "strong Global Environmental Sustainability content" (GES Endorsed Courses, n.d., para. 1). Additionally, at the time of the study, there were six courses offered by SoGES (Figure 5) (Global Environmental Sustainability Courses, n.d.)

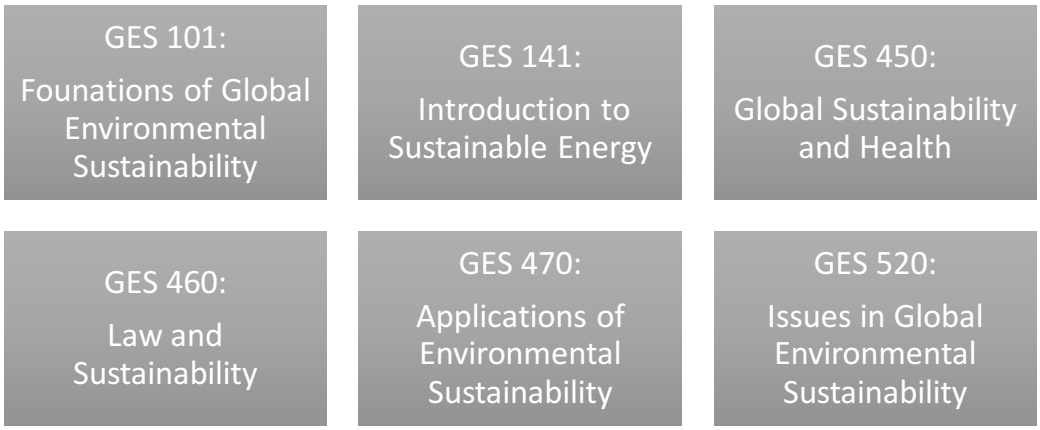

Figure 5. CSU's School of Global Environmental Sustainability Course Offerings.

Previous 2014 Assessment

In 2014 the researcher worked in collaboration with CSU's Housing & Dining Services to discuss developing a sustainability literacy assessment. Housing & Dining Services places considerable focus on sustainability through their Eco Leaders Program (Eco Leaders Program, n.d.), and they were interested in the development of a sustainability literacy assessment tool. In addition to CSU's Housing & Dining Services, the University's President's Sustainability Committee was interested in an assessment tool that could be used for STARS.

Before 2014 CSU's Housing & Dining Services conducted a similar type of assessment, titled the Eco Leaders Eco Literacy Assessment (Appendix B), which is still used within the program. The Eco- Literacy Assessment tool includes knowledge-based multiple-choice questions framed around the TBL. The researcher drew inspiration from and followed the model of the Eco Leaders Eco Literacy Assessment in the development of the assessment tool in 2014.

The assessment tool used in 2014, which is referred to in the study as the CSU 2014 Sustainability Literacy Assessment Tool (Appendix C) was designed with four sections. The first section included knowledge-based multiple-choice questions. The second section included scale-style questions that sought to determine students' attitudes and behaviors toward sustainability. The third section related to sustainability advocacy on campus and was designed with yes or no questions. Finally, the fourth section asked participants about their demographics. The assessment tool was distributed by the University to 3,322 graduate and undergraduate students on September 23, 2014, who received an email invitation from Tonie Miyamoto, CSU Director of Division Communications, inviting them to participate. Three reminder emails were sent on September 30, 2014, November 12, 2014, and December 12, 2014. Data collection ended on December 19, 2014 with 484 total respondents, for a 14.57% response rate. The response rate for the 2014 assessment was calculated based on all respondents.

Upon review of the 2014 assessment findings, it was determined there were challenges to the design of the tool. Due to the combination of sections analysis was complicated, therefore, the researcher made the decision for the 2016 assessment tool's focus to be specifically on knowledge, and be designed with knowledge-based multiple-choice questions instead of items of varying formats.

Purpose of the Study

The purpose of this study was to describe the development, use, analysis, results and revision of an assessment tool that was distributed in Spring 2016 at CSU to assess its students' *sustainability literacy* within the framework of the TBL (Appendix A). Findings from the study will inform CSU of successes and opportunities for the University's *sustainability education*

initiatives. The assessment tool used is referred to as the Colorado State University 2016 Sustainability Literacy Assessment (CSU 2016 SLA).

Sustainability Literacy

Sustainability literacy indicates an individual "having the understanding, skills, attitudes and attributes to take informed action for the benefit of oneself and others, now and into a long-term future" (Diamond & Irwin, 2013, p. 339). Sustainability literacy involves "the ability and disposition to engage in thinking, problem solving, decision making, and actions associated with achieving sustainability" (Nolet, 2009, p. 421). The study tackles the question, how to best assess college students' sustainability literacy.

Sustainability Education

Sustainability education refers to education that incorporates the concept of sustainability and addresses sustainability challenges (Junyent & Geli de Ciurana, 2008; Sherman & Burns, 2015). Going further, sustainability education encourages students to participate in problem- and solution-oriented research (Brundiers & Wiek, 2011, p. 108). Sustainability education addresses complex problems, such as "climate change, poverty, violent conflicts, and overuse of natural resources" (Brundiers & Wiek, 2011, p. 108).

Current Problem

With the growth of sustainability education in IHE, there comes a variety of challenges and issues. Questions arise, such as 1) Should the concept of sustainability be taught? 2) Who is responsible to teach the concept of sustainability? 3) What is included in foundational sustainability education? 4) How to best teach the concept of sustainability? 5) What do students need to know and understand about the concept of sustainability? and so on. The study described does not attempt to answer all of these questions, but points out, one might argue the biggest

challenge to sustainability education is understanding what it is. How is such a broad concept taught? Moreover, the study seeks to understand the best way IHE can assess students' sustainability literacy on such a broad topic.

The important factor to remember is sustainability education is growing throughout higher education, therefore it is critical those in sustainability education work with experts in education to determine method(s) for assessing students' sustainability literacy. However, first IHE must decide a common understanding of what sustainability literacy entails and how it is defined.

AASHE has led the call for IHE to develop a sustainability literacy assessment tool (Assessing Sustainability Literacy, 2012). Currently, the common design for many of the assessment tools used at IHE include knowledge-based multiple-choice questions. However, the researcher argues one assessment tool design may not be a valid measure of sustainability literacy. Problematically, sustainability education is approached differently across IHE. For example, Central College in Iowa requires all students to successfully complete a global sustainability course as a condition of graduation. However, many other colleges and universities, including CSU, have no requirements and instead offer sustainability courses as electives. Though CSU's SoGES offers undergraduate students the opportunity to earn a minor in sustainability and endorses numerous CSU graduate and undergraduate courses across disciplines, students are not required to complete courses that include sustainability education.

Conceptual Framework of Study

There are different approaches to frame the concept of sustainability. Various frameworks have been applied, such as the corporate models of human value management, value driven management, and superior customer value (McFarlane & Ogazon, 2011, p. 82). However,

one of the most common frameworks used to explain the concept of sustainability within higher education is the Triple Bottom Line (TBL). In recent years some sustainability practitioners have reshaped the TBL, such as Waite (2017) who added a future generations dimension to address "the idea of future planning" (p. 5). There is debate among sustainability education experts on the best framework, however the TBL is probably the most common framework used by IHE.

Explaining the Triple Bottom Line

Central to the study is AASHE's definition of sustainability, which fits well within the TBL (Figure 6). AASHE sees the concept of sustainability as "encompassing human and ecological health, social justice, secure livelihoods, and a better world for all generations" (Understanding Sustainability, AASHE, n.d., para. 1).

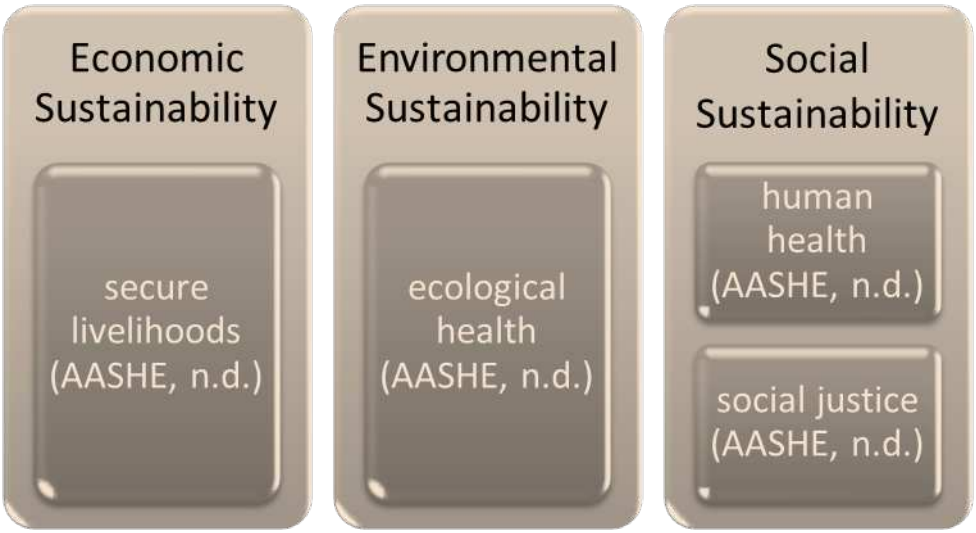

Figure 6. Illustration of how the Definition of Sustainability Fits Within the Triple Bottom Line.

The concept of sustainability is applicable to numerous disciplines and is found across various academic units throughout IHE. Because of this, sustainability education is often framed around the economic, environmental, and social dimensions of the TBL. Economic sustainability was defined for the CSU 2016 SLA as "the ability of an economy to support a defined level of economic production indefinitely" (Economic Sustainability, n.d.). Two topic examples of

economic sustainability include the gender wage gap and the U.S. federal minimum wage. However, both topics are examples found under the umbrella of social sustainability. Social sustainability is the "equal access and opportunity, environmental justice, community and value of place, and basic human needs" (Opp, 2017, p. 286). Other topic examples of social sustainability include access to fresh water and human-made boundaries, in relation to fences and walls. People often debate the need for fences and walls around properties and national borders, however, these may be considered environmental sustainability concerns, too. "Environmental sustainability seeks to sustain global life-support systems indefinitely" (Goodland, 1995, p. 6). Environmentalists might argue against a fence or wall because of the possible negative impact on migratory routes of fauna, which refers to animals living in a region or environment (Fauna, n.d.). Thus, these examples show to understand the concept of sustainability, it is critical for individuals to understand the connections among economic, environmental, and social dimensions of sustainability.

Since its use in the 1990s, the TBL has been embraced by institutions besides corporations, such as national and local governments and academia. For example, at a national level, the U.S. National Environmental Policy Act of 1969 enabled policy "to create and maintain conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations" (Why is Sustainability Important, n.d., para. 1). An example of a local government using the TBL is found in the city of Fort Collins, where CSU is located. The Fort Collins city website Sustainability Services page highlights the community's focus on economic, environmental, and social sustainability.

In academia, various IHE are approaching education and research around the TBL, including Arizona State University (ASU), which established the first school of sustainability in 2006. ASU's School of Sustainability places "focus on finding real-world solutions to environmental, economic, and social challenges" (About the School, n.d., para. 1).

Significance of the Study

The significance of the study is its value to its stakeholders. There were three main stakeholders included in the study, CSU, other institutions of higher education, and AASHE. First, CSU was a stakeholder because the university was using a sustainability literacy assessment tool to report to STARS. Additionally, CSU's SoGES can use the findings from this study to inform decisions regarding sustainability education initiatives. Institutions of higher education were considered stakeholders because administrators can use the findings from this study to assist in developing their sustainability literacy assessment tools. Lastly, the third stakeholder was AASHE. AASHE has been a driver of sustainability literacy and the development of an assessment tool (Pelton, 2012). AASHE plays an important role as it is a platform to potentially distribute the study described in this paper and a sustainability literacy assessment tool.

Research Questions

The study was led by four research questions. The questions were answered through a mixed-methods approach. The four research questions were:

RQ1: What was the CSU student body's performance on the CSU 2016 SLA and each of the three dimensions of the Triple Bottom Line?

RQ2: What are the differences of students' CSU 2016 SLA performance based on demographics?

RQ3: What topics of sustainability will focus group participants report?

RQ4: What were the strengths and weaknesses of using the Triple Bottom Line as the model for the CSU 2016 SLA?

Assumptions

It was assumed respondents of the CSU 2016 SLA would score highest in environmental sustainability literacy. This assumption was based on researcher's observations at the university, such as the sustainability courses offered throughout various academic departments, sustainability marketing displayed around campus and online, and sustainability research, which is often promoted through unit-sponsored lectures. The researcher observed CSU placed considerable attention on environmental sustainability, with the dimensions of economic and social sustainability being less visible on campus. It was also assumed respondents' performance on the CSU 2016 SLA would be related to the respondents' academic level and college of enrollment. Graduate students, seniors, and juniors were expected to answer more questions correctly than sophomores and freshman.

For the focus groups, the researcher assumed most of the participants would be graduate students. There were two reasons for this assumption, one, because graduate students' response rate on the SLA was high and two, the email invitations were distributed to graduate-level courses.

Researcher's Perspective

It is exciting to see sustainability education grow throughout higher education. The variety of topics that fit within the scope of sustainability allows for continued learning for both faculty and students. However, even though higher education, specifically through AASHE, has taken the lead in teaching the concept of sustainability there are many gaps in what is known

about sustainability education. First, the researcher questions the current impact sustainability education is making at the post-secondary education level. It is assumed that more individuals could be reached, thus greater impact, if sustainability education were integrated into K-12 public education. Additionally, based on the review of IHE, more 4-year institutions are implementing sustainability education instead of community colleges, trade schools, and for-profit post-secondary institutions. Students who attend these types of institutions may lack exposure to sustainability education. Second, with the differing sustainability education approaches throughout IHE, it is unwise to assume one sustainability literacy assessment has the ability to appropriately assess students' sustainability literacy across institutions of higher learning. This has been the focus at AASHE and by researchers at Ohio State University and the University of Maryland, who have worked to develop an assessment tool that can be used by different institutions, (Zwickle et al., 2013). However, as will be discussed in greater detail in Chapter 2, each IHE has a different approach to what and how students are exposed to sustainably education.

CHAPTER TWO: LITERATURE REVIEW

An extensive review of literature was conducted on the topic of sustainability education. The review offered a view of the vastness of topics related to the concept of sustainability, and the breadth of academic disciplines incorporating the concept of sustainability within their curriculum. Key search terms included: “sustainability education”, “sustainability literacy”, “sustainability curriculum”, “sustainability teaching and learning”, and “sustainability higher education”. The searches were conducted through EBSCOhost and Google.

Decade of Education for Sustainable Development

In 2002 the United Nations announced its Decade of Education for Sustainable Development (DESD), which ran from 2005-2014 (Junyent & Geli de Ciurana, 2008, p. 763). The UN saw sustainability education as a way to combat global challenges. The UN’s proclamation for sustainability education initiated a call to IHE to integrate the concept of sustainability into curricula across disciplines (Abu-Hola & Tareef, 2009; Chase, 1998; Holmberg et al., 2008; Junyent & Geli de Ciurana, 2008; McFarlane & Ogazon, 2011; Ryan & Tilbury, 2013; Sammalisto & Lindhqvist, 2008; Wakefield, 2003). Incorporating sustainability education into IHE provided “great potential for positive cultural change, as any educational practice carries with it the possibility to either reinforce or transform students’ beliefs and understandings of the world” (Turner & Donnelly, 2013, p. 388). Advocates of sustainability education saw IHE as the ideal place to create a culture of sustainability (A Culture of Sustainability, 2012; Junyent & Geli de Ciurana, 2008). Some thought IHE should act as a “fully integrated community that models social, economic, and biological sustainability itself and in its

interdependence with the local, regional, and global community" (Timpson & Holman, 2011, p. 11).

Sustainability Units in Higher Education

Many IHE answered the UN's call by establishing units of sustainability. ASU established the nation's first school of sustainability in 2006. The School of Sustainability is housed under the Julie Ann Wrigley Global Institute of Sustainability, which promotes solutions, engagement, education, and research that addresses "real-world solutions to environmental, economic, and social challenges" (About the School of Sustainability, n.d., para. 1). ASU's School of Sustainability offers students opportunities to earn undergraduate and graduate degrees in sustainability, including a Doctor of Philosophy in Sustainability.

The first college of sustainability, named the Patel College of Global Sustainability, was established at the University of South Florida (USF) in 2012. The college grew from the Patel School of Global Sustainability, which was established in 2010. Both the school and the college developed from the original Dr. Kiran C. Patel Center for Global Solutions; founded in 2005. The College offers a number of graduate certificates along with a Master of Arts in Global Sustainability, which includes nine concentrations (About the Patel College of Global Sustainability, n.d.).

A review of eighty-seven IHE found forty-five housed a sustainability center, department, institute, school, or college. Nineteen IHE had a sustainability office, but no specific sustainability educational program, and twenty-five IHE offered sustainability concentrations or courses in already-established academic departments (Sustainability: Science, Practice, & Policy, n.d.).

Sustainability Education is Interdisciplinary

Sustainability education focuses on an interdisciplinary educational approach. Interdisciplinary education refers to "an educational framework that advocates a broad, integrative curriculum" (Defining Interdisciplinary, 2009, p. 11). This approach is ideal for sustainability education as "interdisciplinary work holds that such knowledge is a postmodern necessity to solve social problems that cannot be adequately understood through one disciplinary perspective" (Defining Interdisciplinary, 2009, p. 12). Unlike traditional academic units that address one disciplinary focus, the concept of sustainability can be taught across disciplines through different academic units.

School of Global Environmental Sustainability Endorsed Courses

CSU provides a strong example of how the concept of sustainability is addressed within various academic units. The University's SoGES has endorsed undergraduate and graduate courses from different disciplines (Table 1) "that have strong Global Environmental Sustainability content" (GES Endorsed Courses, n.d.). The endorsed courses identified are listed in CSU's online course catalog, which helps "students to identify courses that will strengthen their literacy in complex global environmental sustainability" (GES Endorsed Courses, n.d.).

Table 1. Colorado State University's School of Global Environmental Sustainability Endorsed Courses as of April 2017 ("GES Endorsed Courses", n.d.).

College	# of Endorsed Courses	Academic Departments	Dual-listed Courses
Agriculture Sciences	11	Agriculture and Resource Economics; Animal Sciences; Bioagriculture Sciences & Pest Management; Horticulture and Landscape Architecture; Soil & Crop Sciences	Agriculture Ethics AGRI/PHIL 330 Departments: Bioagriculture Sciences; Philosophy
Business	1	Management	
Engineering	3	Atmospheric Sciences; Civil & Environmental Engineering	Water and Waste Recycling SOCR/CIVE 481 Departments: Soil & Crop Sciences; Civil & Environmental Engineering
Health and Human Sciences	3	Construction Management; Food Science & Human Nutrition	
Liberal Arts	28	Anthropology; Communication; English; History; Journalism & Technical Communication; Philosophy; Political Science; Sociology	
Natural Sciences	3	Biology; Math; Zoology	Theory of Population and Evolutionary Ecology MATH 348/BZ 348 Departments: Math; Biology
Natural Resources	7	Forest & Rangeland Stewardship; Human Dimensions of Natural Resources; Fish, Wildlife, & Conservation Biology	Global Change Ecology in a Changing World NR 353/BZ 353 Departments: Botany; Zoology (CNS)
Total	56		

Sustainable Education across Disciplines

Outside of CSU, the review of literature found many examples of the concept of sustainability being taught across academic disciplines at other IHE. The search terms "sustainability education" and "sustainability curriculum" garnered articles from authors around the globe addressing sustainability education from twenty-six different academic disciplines, however it is probable there are other disciplines addressing sustainability that are not listed. The twenty-six researcher-identified academic disciplines tackling sustainability are shown in Table 2.

Table 2. Academic Disciplines in Higher Education that have Incorporated Sustainability Education into their Curriculum.

Academic Discipline	Articles that address Sustainability Education
adult education	Shallcross & Loubser, 2010
agriculture	Triana, 2016
architecture	Ismail, Keumala & Dabdoob, 2017
art	Gunn, 2016
business	Brumagim & Cann, 2012; Fisher & Bonn, 2011; MacVaugh & Norton, 2012; Painter-Morland, Sabet, Molthan-Hill, Goworek & Leeuw, 2016
civil engineering	Chau, 2007; Christ et al., 2015; Fernandez-Sanchez, Bernaldo, Castillejo, Manzanero & Esteban, 2015; Kevern, 2011; Watson, Noyes & Rodgers, 2013
chemical engineering	Glassey & Haile, 2012; von Blottnitz, Case & Fraser, 2015
chemistry	Guron, Paul & Roeder, 2016; Turner, 2013
construction	El-adaway, Pierrakos & Truax, 2015; Lewis, Valdes-Vasquez, Clevenger & Shealy, 2015; Wang, 2009
design	Klein & Phillips, 2011; Kjollesdal, Asheim & Boks, 2014
education	Cavas, Ertepinar & Teksoz, 2014
engineering	Apul & Philpott, 2011; Azapagic, Perdan & Shallcross, 2005; Byrne, Desha, Fitzpatrick & Hargroves, 2013; Manoliadis, 2009; Mulder, 2017
environmental engineering	Watson, Noyes & Rodgers, 2013
fine arts	Clarke & Hulbert, 2016
geography	Bagoly-Simo, 2014; Brooks, 2016; Liu, 2011; Widener, Gliedt & Tziganuk, 2016
geographic information systems	Hwang, 2013
hospitality	Deale & Barber, 2012
interior design	Stark & Park, 2016
international marketing	Perera & Hewege, 2016
language	Hubscher-Davidson & Panichelli-Batalla, 2016
management	Fisher & Bonn, 2011
nursing	McMillan, 2014

outdoor education	Higgins & Kirk, 2006; Nicol, 2014
teacher education	Higgins & Kirk, 2006; Falkenberg & Babiuk, 2014
tourism	Benckendorff, Moscardo & Murphy, 2012; Farber Canziani, Sonmez, Hsieh & Byrd, 2012
women's studies	Fahs, 2015

Teaching Sustainability

A review of literature on "sustainability education" and "sustainability curriculum" identified many articles discussing best-practice approaches to teaching and learning the concept of sustainability. Authors discussed the importance of using non-traditional methods in teaching the concept of sustainability. Instead of lectures, faculty are finding it beneficial to use creative methods to teach the concept of sustainability because non-traditional teaching and learning methods encourage students' critical thinking and engagement. These include case-based instruction, experiential learning, problem-based learning, role-play learning, service learning, and teamwork (Figure 7).

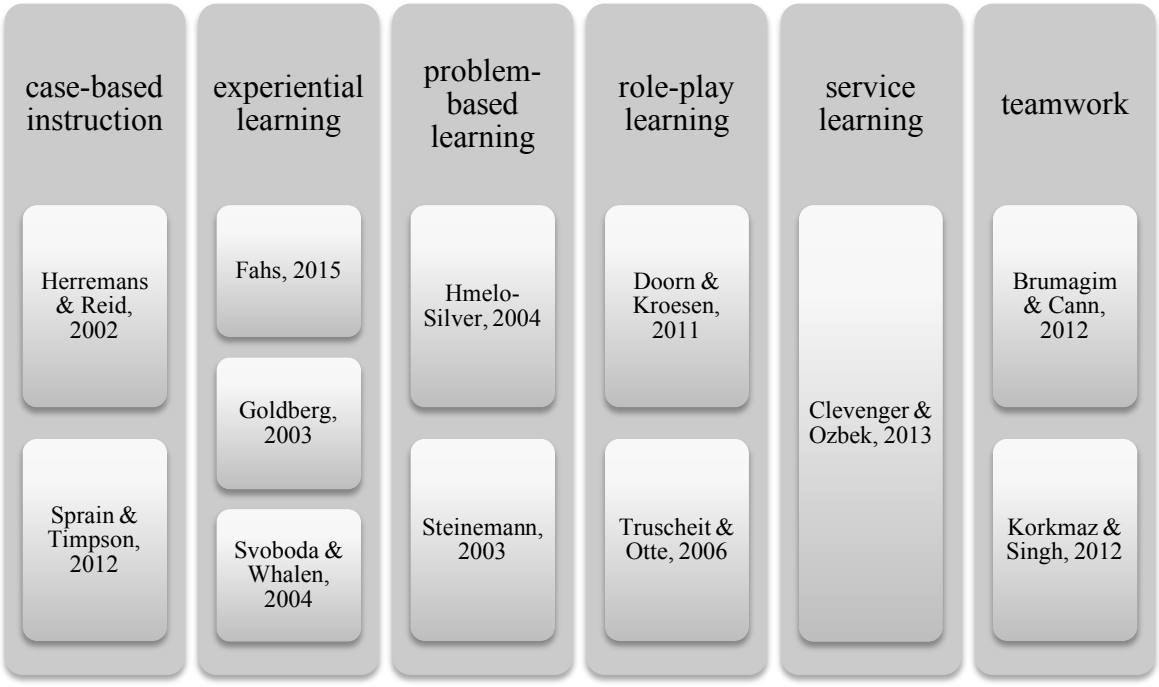

Figure 7. Teaching Methods in Sustainability Education Described in Scholarly Articles.

Identifying Learning Outcomes of Sustainability Education

Another aspect of sustainability education is expected learning outcomes for the target group of students. As indicated in the definition of sustainability literacy, the purpose of sustainability education in higher education is to develop individuals who have the ability "to engage in thinking, problem solving, decision making, and actions associated with achieving sustainability" (Nolet, 2009, p. 421). Bloom's Taxonomy (Bloom, 1956) was used as a framework to analyze teaching and learning methods discussed in the literature. The review of literature combined with the definition of sustainability literacy, led to the discovery that sustainability education should focus on learning objectives that are at the "apply" level or higher. However, a review of current sustainability literacy assessments being used at IHE found the assessments are testing "knowledge", which is the first level of Bloom's Taxonomy. The six levels originally developed by Benjamin Bloom in 1956 to classify educational learning objectives are illustrated in Figure 8 (Fracturs Learning, n.d.).

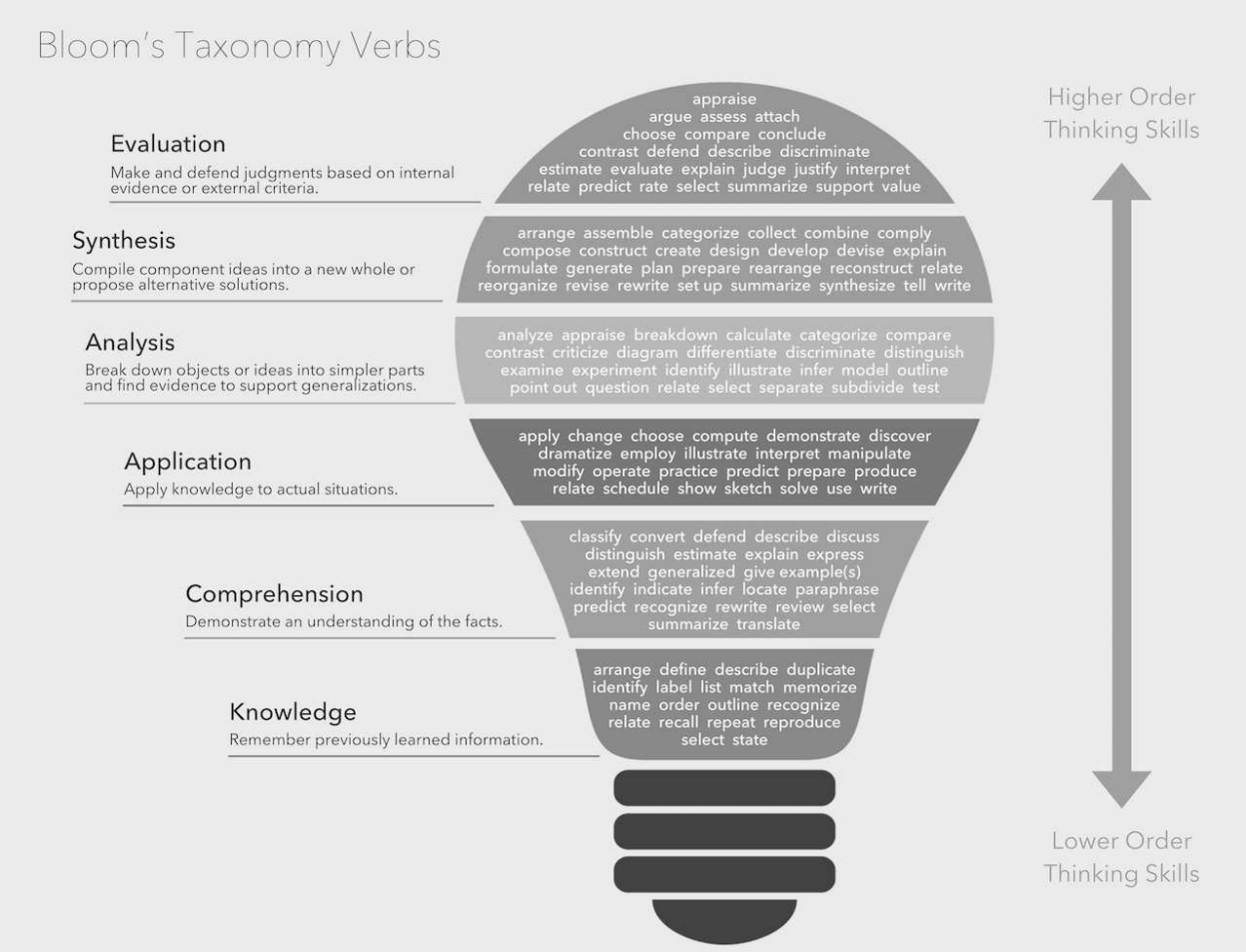

Figure 8. Bloom's Taxonomy (Fracturs Learning, n.d.).

Examples of Sustainability Education Teaching and Learning Methods

Even though many IHE have developed knowledge-based assessments, a review of literature found many sustainability educators seek to encourage students to participate in activism and community engagement. Six methods were selected that provide examples of how faculty are teaching the concept of sustainability. The methods described are examples, and other sustainability educators may use others that were not found in the literature.

Case-based instruction approach. Case-based instruction refers to the use of case studies in teaching. Using a case-based instruction approach gives "students opportunities to apply their knowledge with real world examples, to deepen their understanding through analysis,

synthesis, and evaluation" (Timpson & Holman, 2011, p. 14). Sprain and Timpson (2012) explain "strong case studies are often reasonably complex to allow students to explore context and consider the interrelationships between different people and system dynamics" (p. 7). This approach has been very useful in teaching the concept of sustainability in higher education as it encourages engagement in deep discussions around moral choices (Timpson & Holman, 2011, p. 14). Thus, case-based instruction encourages undergraduate and graduate level students to evaluate a topic based on all the information presented in a case study. Timpson and Holman (2012) share numerous case studies across various academic disciplines and academic levels. Because case-based instruction encourages students to explore, analyze, synthesize, and evaluate, this approach was determined as meeting the Bloom's Taxonomy level of "evaluation".

Experiential learning approach. Experiential learning refers to learning through experience. Fahs (2015) provides an example of using experiential learning in an upper-division cross-listed women and gender studies/social justice and human rights course "Trash, Freaks, and SCUM" at ASU. With SCUM, Fahs (2015) refers to the manifesto by Valerie Solanas, "S.C.U.M. Society for Cutting Up Men". Students are required to complete a "trash-bag assignment, which asks students to collect the trash they personally produce for two periods of two days each and carry the bag of trash with them at all times for those 48-hour periods" (Fahs, 2015, p. 32). The purpose included three goals for students, 1) to be aware of their personal production of trash, 2) to encourage discussions on trash with others, and 3) to focus attention on the relationship between their own behaviors and choices and larger global issues, such as climate change (Fahs, 2015, p. 32). The "assignment emphasizes the importance of thinking about trash as a social and political pathology" (Fahs, 2015, p. 32). Experiential learning pushes

students to apply what they have learned and build connections, which is why this approach fits within the "application" and "analysis" levels on Bloom's Taxonomy.

Problem-based learning approach. Problem-based learning is a focused, experiential learning approach that addresses a specific problem through investigation and explanation often through use of small collaborative groups (Hmelo-Silver, 2004, p. 236). Steinemann (2003) designed and taught a graduate-level course at the Georgia Institute of Technology called "Sustainable Urban Development" (p. 219). The course required graduate students to learn how their projects could assist existing operations, obtain feedback from stakeholders, offer ideas, find ways to reduce barriers, demonstrate evidence of benefits and cost savings, generate support and ownership for the projects, develop a foundation for future use or continued work, and create a useful and beneficial project that will be accepted by stakeholders (Steinemann, 2003, p. 219). Steinemann (2003) advocated the use of problem-based learning because "problem solving often requires more than an analytic exercise on paper; it requires working with people and organizations" (p. 216), thus students gain real experience they can use later. Steinemann (2003) summarizes the idea of problem-based learning by showing it "emphasizes learning by doing" (p. 218). The researcher saw problem-based learning to be at "synthesis" and "evaluation" levels of Bloom's Taxonomy.

Role-play learning approach. With the role-play learning approach students take on different roles and act out a scenario. An established role-play learning activity 'NordWestPower' is found in the basic Ecological Economics course at the University of Oldenburg in Germany (Truscheit & Otte, 2006). The authors (2006) explain the second-year undergraduate course includes a semester-long behavior-oriented role-play where students are sustainability managers who evaluate the social and ecological risks of their field (p. 51). In the

article, Truscheit and Otte (2006) argue conventional teaching such as lectures and seminars are not appropriate for teaching competences of decision-making, project management, presentation, and learning techniques; social competences of teamwork, integration, conflict resolution, motivation, and communication; and individual competences of creativity, flexibility, networked intellect, leadership qualities, and self-reflection (p. 52). Role-play shows the relevance of instructional contents and helps the contents become clearer (Truscheit & Otte, 2006, p. 55) because it requires students to act out, or apply, what they know about a topic. Additionally, role-play encourages students to analyze different points-of-view, therefore this approach is at the "analysis" and "synthesis" levels of Bloom's Taxonomy.

Service learning approach. Service learning "promotes educational experiences in which students participate in and reflect upon organized activities that meet identified community needs to gain further understanding of the concepts being taught" (Clevenger & Ozbek, 2013, p. 1). To assess the effectiveness using the service learning approach in their graduate-level construction course, Clevenger and Ozbek (2013) used a framework of five community-based research learning outcomes. The five constructs included academic skills, educational experience, civic engagement, professional skills, and personal growth. To gain an understanding of the students' perceived learning outcomes Clevenger and Ozbek (2013) collected data from their students through surveys, reflections, and concept maps. The use of service learning increased students' sustainability competencies within the key areas of systems thinking, long-term foresighted-thinking, stakeholder engagement and group collaboration, and action-orientation and change agent skills. The authors suggest "service learning may be an effective educational pedagogy to support learning outcomes related to sustainability in construction education" (Clevenger & Ozbek, 2013, p. 8). Similar to problem-based learning,

service learning encourages students to analyze and draw connections from the interactions they witness with the people they work with on the project and apply what they know. With service learning the student is immersed in a scenario that addresses an issue or includes various problems. The researcher distinguished this approach to be at "analysis" and "synthesis" levels of Bloom's Taxonomy.

Teamwork approach. In the teamwork approach students work to create a solution for a problem as a group. Korkmaz and Singh (2012) advocate using team projects to teach the concept of sustainability and studied the use of the teamwork approach in a senior-level course, taught at Michigan State University. They found "integrated student teams produce more comprehensive outputs for sustainable projects" (Korkmaz & Singh, 2012, p. 290). Additionally, they report certain variables are meaningful in project performance including "project communication, information exchange, experience, reliance, trust, and value sharing" (Korkmaz & Singh, 2012, p. 293). Most importantly, the teamwork approach supports interdisciplinary "leadership, teamwork, and communication" (Korkmaz & Singh, 2012, p. 294). Teamwork meets the "synthesis" and "evaluation" levels on Bloom's Taxonomy.

Understanding Sustainability

The goal of sustainability education is for students to understand the concept of sustainability and apply what they know. However, considering the vastness of topics that can be applied to the concept of sustainability, it is challenging to determine what students really need to know and understand. In the broad scope, sustainability literacy requires individuals "having the understanding, skills, attitudes and attributes to take informed action for the benefit of oneself and others, now and into a long-term future" (Diamond & Irwin, 2013, p. 339). Therefore, sustainability literacy is not so much about knowing facts, but instead about an understanding of

the concept of sustainability, and ultimately becoming active citizens. This stance is supported by others' definitions of sustainability literacy, such as, "sustainability literacy is the knowledge, skills and mindsets that help compel an individual to become deeply committed to building a sustainable future and allow him or her to make informed and effective decision to this end" (About Sulitest, n.d., p. 2), and [sustainability literacy is] "the ability and disposition to engage in thinking, problem solving, decision making, and actions associated with achieving sustainability" (Nolet, 2009, p. 421).

Higher Education's Push to Develop a Sustainability Literacy Assessment

One of the biggest drivers for assessing students' sustainability literacy is the non-profit organization, AASHE. STARS, developed and distributed by AASHE, encourages IHE to conduct a student sustainability literacy assessment (STARS Technical Manual, 2017). AASHE does not provide a sustainability literacy assessment tool, therefore, most participants of STARS borrow assessment tools created at other institutions or use self-developed tools.

A review of sustainability literacy assessment tools reported to STARS in 2016 was conducted through the STARS' website (STARS Participants & Reports, n.d.). One-hundred and six IHE submitted a STARS report in 2016, however not all institutions reported an assessment of their students' sustainability literacy. Some IHE stated on their STARS report they were in the process of developing an assessment tool. Thirty-six participating IHE (STARS Participants & Reports, n.d), or thirty-four percent of all STARS 2016 participating IHE, reported their students' sustainability literacy and shared their assessment tool, or sample questions, on their STARS 2016 report. A review of those assessment tools found they were developed in the same manner as the CSU 2016 SLA, using a multiple-choice question design, and focusing on questions related to the TBL. The thirty-five IHE are displayed in Figure 9.

Figure 9. STARS 2016 Reporting Institutions that Used Sustainability Literacy Assessments.

Current Assessment Design and Questions

Due to the breadth of topics that fall under the umbrella of the concept of sustainability it can be difficult to select topics to assess literacy. According to Obermiller and Atwood (2013) the most important topics to include on a sustainability literacy assessment tool includes "climate change, energy, planetary assets [such as] land, water, air, biodiversity, systems concepts, people, and organizations" (pp. 4-5). Their thoughts align with those of Horvath, Steward, and Shea (2013) who created an assessment tool that focused on the University of Maryland's list of learning outcomes for sustainability education, such as human population growth, climate change, and food (p. 18).

From the review of sustainability literacy assessment tools it was found that numerous IHE, such as Ohio State University, used the TBL as the framework for designing their tool (Zwickle, Koontz, Slagle, & Bruskotter, 2013). Ohio State University has been one of the leading institutions in developing an assessment tool, and their work is highlighted on the AASHE website (Urbanski & Rowland, 2012). Additionally, based on the review of sustainability literacy assessment tools found on the STARS website, participating IHE have designed their assessment tools with knowledge-based multiple-choice questions.

Literature Review Summary

The review of literature on sustainability education found articles that advocated a culture of sustainability, specifically through the implementation of teaching the concept of sustainability in higher education, those that explained how and where the concept of sustainability is being taught, and others that described how IHE are addressing the development of a sustainability literacy assessment. However, what is important is what the review of literature did not find. There are numerous articles on sustainability education and many address sustainability literacy, however, limited literature was found that discussed the development of a sustainability literacy assessment. Experts and educators of sustainability education need to determine baseline levels for students, and to do so, it is critical that each IHE that offers sustainability education has an appropriate sustainability literacy assessment tool.

CHAPTER THREE: METHODS

The purpose of the study was to describe the development, use, analysis, and results of an assessment tool, called the CSU 2016 SLA, used to assess students' sustainability literacy in Spring 2016. The results will inform the University of success and opportunity areas of the University's sustainability education. In this chapter the research methods are discussed in detail. Leading the methods were four research questions, which are listed:

RQ1: What was the CSU student body's performance on the CSU 2016 SLA and each of the three dimensions of the Triple Bottom Line?

RQ2: What are the differences of students' CSU 2016 SLA performance based on demographics?

RQ3: What topics of sustainability will focus group participants report?

RQ4: What were the strengths and weaknesses of using the Triple Bottom Line as the model for the CSU 2016 SLA?

Setting

The study was conducted at CSU, a public research university located in Fort Collins, Colorado a city with a population over 156,000 (Fort Collins Facts, 2015). CSU, a land grant university, is comprised of eight colleges and a veterinary teaching hospital.

CSU was the ideal university location because of its history in environmental education, and more recently, the University's drive in sustainability education. The University established SoGES in 2008, which offers minors and courses that address the concept of sustainability: Minor in Global Environmental Sustainability, Sustainable Water Interdisciplinary Minor, Peace & Reconciliation Studies Minor, Global Environmental Sustainability endorsed courses across

seven of the eight colleges. Additionally, on its website, http://green.colostate.edu/, CSU claims to offer 962 courses at undergraduate and graduate levels that address sustainability in some way.

In addition to learning about sustainability in formal classes, students are exposed to sustainability through various activities, programs, and events. For example, CSU's Housing & Dining Services address and promote sustainability in many ways, including the Eco Leaders Program where "students in the residence halls … help raise awareness about sustainability issues and encourage environmentally-responsible behaviors" (HDS Sustainability Contributions, n.d., para. 1); the Ram Welcome Zero waste picnic; the Composting Program; and in its focus to increase the percentage of organic, local, and or third party verified foods and products offered in residence halls (HDS Sustainability Contributions, n.d.).

Research Design

The idea for the design of the study developed after analyzing results from the 2014 CSU Sustainability Literacy Assessment. After reviewing the 2014 results, the researcher became aware of the need for an assessment tool that more accurately assessed students' sustainability literacy, however with limited models available, beginning this task was challenging. The design of the CSU 2016 SLA tool followed an approach used by researchers at other IHE, such as Ohio State University (Zwickle, Koontz, Slagle, & Bruskotter, 2013). However, wanting to further understand what students know and understand about the concept of sustainability, the researcher also conducted four focus groups as a method to capture qualitative data, which was used to think about the design of the sustainability literacy assessment tool.

Development of Sustainability Literacy Assessment Tool

The tool used in the study was the CSU 2016 SLA (APPENDIX A), which was developed by the researcher and distributed by CSU. The CSU 2016 SLA was a multiple-choice knowledge-based tool used to obtain quantitative data to determine students' sustainability literacy. The tool was developed in collaboration with various experts from CSU, and informed by a content analysis of sustainability literacy assessment tools used by other institutions of higher education and reported to STARS (STARS Participants and Reports, n.d.).

The CSU 2016 SLA was based on the model of the TBL because CSU's SoGES includes the framework in its mission. The assessment tool included 40 questions with the majority being close-ended, with four or five items to choose the one correct response (Dillman, Smyth, & Christian, 2014, p. 134). The first question was close-ended that included a scale-design; students were asked to rate their perceived level of sustainability knowledge by selecting a number, one through ten, with one indicating low knowledge and ten representing high knowledge. After the first question, the next two questions were general sustainability questions. The general sustainability questions did not fit within one of the three dimensions of the TBL.

After the general questions, each of the next three sections represented a dimension of the TBL: environmental (Q4 - Q12), economic (Q13 - Q 21), and social (Q22 - Q30). There were nine questions in each of these three sections. The final section was the demographics (Q31 - Q37), which included questions that asked students if they were aware of the different opportunities to study sustainability at CSU (Question #38) and where they have learned about sustainability at CSU (Question #39). The answers to these two questions were of interest to the University's SoGES Curriculum Committee to help inform their decisions related to sustainability education initiatives.

Data Collection

Data were collected through a mixed-methods approach. Quantitative data were collected through the university-administered CSU 2016 SLA. The CSU 2016 SLA was distributed by CSU using the online platform Campus Labs®. Campus Labs® is an integrated software and cloud-based assessment tool developed for higher education. Qualitative data were collected through four researcher-led focus groups. Collection of data began in February 2016 with the initial distribution of the CSU 2016 SLA and ended in March 2017 when the last focus group was conducted.

The study was approved by CSU's Institutional Review Board in two phases. In phase one approval to analyze the data collected from the CSU 2016 SLA was obtained. This phase of the study was approved by CSU's Institutional Review Board on December 15, 2015 (Appendix D). The next phase, which consisted of researcher-led focus groups conducted, was approved by CSU's Institutional Review Board on December 5, 2016 (Appendix E). It was determined by the review board that consent forms were not needed for focus group participants.

Recruitment of Respondents and Participants

All respondents and participants were CSU students who were enrolled at the University during the time of their participation. Students who completed the CSU 2016 SLA are referred to as respondents and students who participated in one of the four focus groups are referred to as participants.

Students were initially recruited to participate in the CSU 2016 SLA through an email sent by Tonie Miyamoto, Director of Division Communications (Appendix F). The email was sent to a random sample of 5,169 undergraduates, graduates, and professional CSU students on February 11, 2016. Students were asked to click on a link to gain access to the assessment tool,

however before students could begin the assessment they were required to read and accept a consent form (Appendix G). Two reminder emails were sent to the same random sample on March 10, 2016 and March 21, 2016 (Appendix H). The CSU 2016 SLA was open to respondents until March 28, 2016.

Recruitment of participants for the focus groups began in January 2017. The researcher contacted 52 respondents who had responded earlier to Question #40 on the CSU 2016 SLA. The 52 students received an email invitation to participate in one of four focus groups (Appendix I). In addition to the fifty-two CSU 2016 SLA respondents, other CSU students were invited to participate in a focus groups through snowball sampling. The researcher created a second email invitation (Appendix J), which was distributed to CSU faculty, staff, and graduate students who were asked to share the invitation with other students. The faculty, staff, and graduate students were selected because the researcher knew them personally or had met them at a CSU event. Students interested in participating in the focus groups were asked to respond to the email and confirm a date and time to attend.

Focus Group Procedures

The researcher hosted four focus groups, which were all conducted in a SoGES conference room. In each focus group a facilitator assisted. In total there were three facilitators, two assisting with one focus group each and one assisting with two focus groups. The facilitators were graduate students who were paid twenty dollars per focus group. The facilitators were asked to take notes, which they did on a pad of paper and assist with focus group logistics. The facilitators' notes were not used as data. The focus groups were audio recorded. Two recording devices, an iPad and iPhone, were used. Food snacks and beverages were offered to the participants.

At the beginning of each focus group the participants were told the purpose of the study, the focus groups process, and how data would be used. To collect demographic data, participants were asked to complete a short survey at the beginning. The demographic questions were the same questions that were asked on the CSU 2016 SLA. Focus group participants were also asked about their awareness of CSU's sustainability educational opportunities and where they have learned about sustainability.

Participants were each given a small pads of sticky notes and pen. The researcher hung three large (2 feet by 2 feet) sticky sheets of paper on to the whiteboard, each labeled with one dimension of the TBL. Additionally, a presentation flip chart was used with the word sustainability written at the top of the sheet of paper, which indicated the overall concept of sustainability.

The focus groups were led by four questions: 1) What words come to mind when you hear the word "sustainability"?; 2) What words come to mind when you hear "economic sustainability"?; 3) What words come to mind when you hear "environmental sustainability"?; 4) What words come to mind when you hear "social sustainability"?

Participants were asked to share the words or phrases they thought of after being asked the questions. For the first question, words and phrases provided by participants were written on a large white sheet of paper that was hung on the presentation tripod. After the participants had exhausted their list, they were then asked to use their sticky notes to write words or phrases they thought of for the TBL dimensions. The participants were given five to seven minutes to answer each question. The facilitator picked up the sticky notes as the participants completed them, placing them on the corresponding large sheet. After completing this task for each dimension of the TBL, participants were asked to discuss their responses, specifically to elaborate about

certain words or phrases. The discussion period lasted about fifteen to twenty minutes in each focus group. At the conclusion of each of the focus groups, participants were thanked for their time.

Data Analyses

Data analysis was conducted through a mixed-methods approach. The data were analyzed to provide CSU with information about students' sustainability literacy and inform about potential revisions to the assessment tool.

During analysis of the CSU 2016 SLA it was determined that responses for Question #15 and Question #16 in the economic sustainability dimension would be removed. Question #15 asked respondents if there was a wage gap between women and men in the United States. There were three response options, 1) Yes, 2) No, and 3) I don't know. Only respondents who answered Yes were directed to Question #16, therefore, 43 respondents were not given the opportunity to answer this question.

Quantitative Data Analyses

Data collected from the CSU 2016 SLA was analyzed in SPSS. Descriptive statistics were calculated to determine the overall mean performance for all respondents, respondents' performance per dimension of the TBL, and performance based on demographics. The demographics that were analyzed are shown in Figure 10.

Figure 10. Four Demographics for Comparison of 2016 SLA Scores

Qualitative Data Analyses

First-level coding (Miles & Huberman, 1994, p. 69) was used in the study with the CSU 2016 SLA. The purpose for developing the codes was to compare focus group participants' words and phrases with the question topics from the CSU 2016 SLA. After codes were developed they were re-analyzed to be grouped together, using the approach of pattern coding (Miles & Huberman, 1994, p. 69). These groups were labeled as themes. Codes and themes were organized within the TBL framework.

The words and phrases provided by the focus group participants were organized within Atlas.ti, a software program used to assist qualitative analysis approaches. After inputting and analyzing the codes, the codes were grouped together in themes using the pattern coding approach. Atlas.ti was used because it offered a platform to store the codes and themes and to allow easier analysis and organization of the codes and themes

The focus group audio-recordings were transcribed by the researcher. The transcriptions were uploaded to Wordle.com, an online word cloud generator. Word clouds were used to provide the researcher with a quick sense of the key words from the focus groups (Ramsden & Bates, 2008). The word clouds were helpful in determining the themes from the focus groups' conversations.

CHAPTER FOUR: RESULTS

The purpose of the study was to describe the development, use, analysis, and results of the sustainability literacy assessment tool used at CSU in Spring 2016, titled the CSU 2016 SLA. Chapter four specifically highlights the data results from the study, which was led by four research questions.

RQ1: What was the CSU student body's performance on the CSU 2016 SLA and each of the three dimensions of the Triple Bottom Line?

RQ2: What are the differences of students' CSU 2016 SLA performance based on demographics?

RQ3: What topics of sustainability will focus group participants report?

RQ4: What were the strengths and weaknesses of using the Triple Bottom Line as the model for the CSU 2016 SLA?

Before addressing the four research questions, the response rates are provided, along with the CSU 2016 SLA respondents' demographics and the focus group participants' demographics, and CSU's overall population data from each of the corresponding academic terms that data were collected (Institutional Research, 2016; 2017). STARS participants are encouraged to reach "a subset of a statistical population that accurately reflects the members of the entire population. A representative sample should be an unbiased indication of what the entire population is like" (STARS 2.1 Technical Manual, 2017, p. 58).

Response Rates

A random sample of 5,169 CSU undergraduates, graduates, and professional students received an email invitation to participate in the CSU 2016 SLA. The CSU 2016 SLA was

presented to students as the CSU Student Sustainability Survey. The 5,169 students represented 20% of CSU's total 25,787 student enrollment in Spring 2016. Of the random sample invited, there were 633 respondents, with 429 students who answered all questions on the CSU 2016 SLA. Based on 429 respondents who answered all of the multiple-choice knowledge-based questions, the response rate was 8.3% of the 5,169 invited students.

Initially, 52 respondents from the CSU 2016 SLA were invited to participate in one of the four focus groups. Of the 52 respondents, two participated in a focus group for a response rate of 3.85%. Because the response rate was low from this initial group of SLA participants, snowball sampling was used to recruit more participants. In total 15 focus group participants, with seven participants at the first focus group (February 10, 2017), two participants at the second focus group (February 13, 2017), four participants at the third focus group (February 21, 2017), and two participants at the fourth focus group, which was held on March 7, 2017.

Assessment Tool Demographics

Of the 429 respondents, 23, or 5.36%, identified as international students. During the Spring 2016 semester 1,918 international students were enrolled at CSU, or 7.4% of the total student body.

About one-fourth of the respondents stated they lived in University-sponsored housing, in either the CSU residence halls or University apartments. On average, 5,000 students (20%) of the student body live in CSU-sponsored housing each semester. Seventy-six percent of the respondents lived in non-University housing, and 80% of the student body in Spring 2016 lived in non-University housing.

The academic level of most respondents were graduate students (n = 128), followed by juniors (n = 94), seniors (n = 79), sophomores (n = 61), freshmen (58), professional (n = 3), and

six respondents who identified as other or did not respond. The percent of 29.9 graduate students was almost double the percentage of graduate students who made up CSU's total graduate student enrollment in Spring 2016 (14.7%). In total, 1.7% of CSU's student body responded to the CSU 2016 SLA (Table 3).

Table 3. Academic level. Counts and percentages of the CSU 2016 SLA respondents and the Spring 2016 total enrollment.

Academic Levels	SLA Count	SLA %	CSU Count	CSU %
Freshman	58	13.5	4,088	15.9
Sophomore	61	14.2	4,866	18.9
Junior	94	21.9	5,132	19.9
Senior	79	18.4	7,366	28.6
Graduate	128	29.9	3,789	14.7
Professional	3	00.7	546	02.0
Other	6	01.4	0	0
Total	429	100.0	25,787	100.0

Most of the CSU 2016 SLA respondents were enrolled in the College of Natural Sciences (CNS) followed by the College of Health and Human Sciences (CHHS) and the College of Liberal Arts (CLA). These were the three largest colleges at CSU in Spring 2016 (Table 4).

Table 4. College of Enrollment. Headcounts and percentages for CSU 2016 SLA respondents and student body Spring 2016.

CSU Colleges	SLA Count	SLA%	CSU Count	CSU %
CAS	29	06.8	1,512	05.9
COB	31	07.2	2,421	09.4
ENGRG	51	11.9	3,118	12.1
CHHS	69	16.1	4,602	17.8
CLA	74	17.2	4,462	17.3
CNS	82	19.1	4,047	15.7
CVMBS	29	06.8	1,574	06.1
CNR	45	10.5	1,688	06.5
Undeclared	4	00.9	0	00.0
Other	11	02.6	0	00.0
Don't know	4	00.9	0	00.0
Total	429	100.0	25,787 RI	100.0

Almost 76% of the CSU 2016 SLA respondents identified as being White or Caucasian. This percentage is representative of CSU's Spring 2016 total student enrollment, where 70% identified as White or Caucasian.

The majority of respondents, 68%, fell within the age group that is considered to be a traditional college student, under the age of 24 years. Generally, students over the age of 24 are considered non-traditional students, however this only applies to undergraduate students. CSU's total student enrollment in Spring 2016 was comprised of 82% of students who were considered traditional college students.

Of the 429 respondents, 425 reported their gender, with 4 respondents preferring not to provide this information. Sixty-one percent identified as female (n = 259), 35% of the respondents identified as male (n = 152), and 3% of respondents identified as either transgender, gender non-conforming, or other (n = 14). The majority of students in Spring 2016 were female (51%), while male students made up 49% of the student body. Institutional Research reports data for females and males.

Focus Group Demographics

The focus groups offered insightful information about sustainability education at CSU, and valuable discussions on the sustainability topics of interest to the students. With the majority of the participants being graduate students (Table 5), the researcher believed the sessions illustrated higher level thinking or the "evaluation" level on Bloom's Taxonomy (Bloom, 1956).

Table 5. Academic levels. Focus group participants and enrollment numbers and percentages, Spring 2017.

Academic Level	FG Count	FG %	CSU Count	CSU %
Freshman	0	00.0	3,934	15.0
Sophomore	2	13.3	5,163	19.7
Junior	1	06.7	5,400	20.6
Senior	2	13.3	7,407	28.3
Graduate	8	53.3	3,744	14.2
Professional	0	00.0	565	02.2
Other	2	13.4	0	00.0
Total	15	100.0	26,213	100.0

Students enrolled in the College of Health and Human Sciences made up 40% of the focus group participants. Both the College of Liberal Arts and the College of Natural Resources made up 20% of focus group total participants. Unfortunately, there were no participants from the College of Business, College of Natural Sciences, and the College of Veterinary Medicine and Biomedical Sciences (Table 6).

Table 6. College of Enrollment. Focus group participants' enrollment and Spring 2017 enrollment per college.

CSU Colleges	Focus Group Count	% of Focus Group Participants	# of CSU students enrolled Spring 2017	% of CSU students enrolled Spring 2017
CAS	1	06.7	1535	05.9
COB	0	00.0	2494	09.5
ENGRG	1	06.7	3241	12.4
CHHS	6	40.0	4703	18.0
CLA	3	20.0	4493	17.1
CNS	0	00.0	4231	16.1
CVMBS	0	00.0	1655	06.3
CNR	3	20.0	1763	06.7
Other	1	06.6	0	00.0
Total	15	100.0	26,213	100.0

There was little diversity in regard to cultural and/or ethnic background. This was unfortunate, as it would have been relevant to have a more inclusive group of students from diverse cultural backgrounds. The focus groups were not intended to be a representation of the

CSU student population, as with the respondents of the CSU 2016 SLA. From the focus groups, fourteen participants identified as White or Caucasian and one student identified as Asian. However, there was a mix of ages, with the mean age being 30 years and a range of 20 years to 36 years. This was not surprising since the majority of participants were enrolled as graduate students. There was almost equal female and male participants in the focus groups.

Respondents' Perceived Level of Sustainability Knowledge

The first question on the CSU 2016 SLA was designed as a scale, and asked students to rate their perceived level of sustainability knowledge, from a low level of sustainability knowledge (1) and a high level of sustainability knowledge (10). Analysis found 424 of the 429 respondents answered this question. Of the 424 the mean = 6.49. The results from show there is an opportunity to improve students' perceived knowledge of sustainability. The responses to this question leads to other questions, such as, what is missing from CSU's sustainability education? Respondents' ratings are shown in Figure 11 with ratings of 5 to 8 including 71% of the respondents.

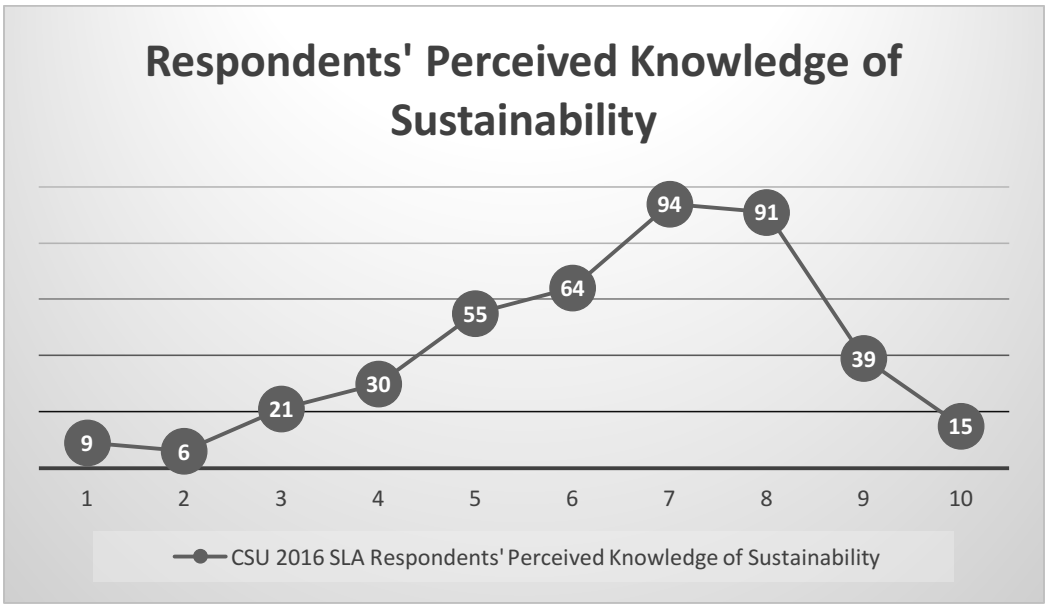

Figure 11. Respondents' Perceived Knowledge of Sustainability Scores

Students' Overall SLA Performance

Data from the CSU 2016 SLA were analyzed to identify the respondents' overall performance, the total number of correct responses. Dividing the total number of correct responses (n = 6,478) by the total number of responses (n = 11,583) found fifty-six percent of the questions were responded to correctly.

A key finding from analyzing respondents' overall performance was the number of respondents who incorrectly responded to the question that asked them to identify the definition of the TBL (Question # 4). The majority of responses were incorrect (77%) with 23% of the responses answered correctly.

Students' Performance per Dimension of the Triple Bottom Line

Descriptive statistics were used to determine students' performance on the CSU 2016 SLA across the three dimensions of the TBL. Respondents performed best on the environmental dimension section of the assessment. Performance on the environmental sustainability questions was calculated based on the number of correct responses (n = 3,001) divided by the number of responses for all environmental sustainability questions (n = 3,861). Seventy-eight percent of all responses were correct. Next, the respondents performed highest on the economic sustainability questions. Of the 3,003 responses to the economic sustainability questions, 1,438 were answered correctly (48%). The dimension with the fewest correct responses was social sustainability. Forty percent of the responses were answered correctly, or 1,549 of 3,861 responses. These findings were consistent with the findings from the focus groups, which identified social sustainability as being the dimension students knew less about.

Students' Demographics and Assessment Performance

Respondents' overall performance was analyzed per certain demographics. The results are reported showing the percentage of correct responses per each demographic group.

The first demographic analyzed was academic level. Freshman had 54% correct responses, sophomores 53%, juniors 55%, seniors 55%, graduate students 59%, and professional students 72%. This shows slight increase by more correct responses based on students' academic level.

Data were analyzed based on college of enrollment. CAS students had 59% correct responses, followed by ENG and CNR students at 58%, CLA students 57 %, CHHS students 54%, COB students 50%, CNS students 56%, CVMBS students 57%. Though there were slight differences among scores, college of enrollment did not have much impact on percentage correct.

Respondents' who reported living in University housing correctly responded 54%, where respondents' who reported living in non-University housing correctly responded 57%. Again, there was not much difference in performance based on the demographic of housing.

Finally, gender indicated little difference in performance with females correctly answering 55% of the responses and males correctly responding 58% of the time.

Overall, there were few differences in correct responses based on demographics. These findings led to the researcher questioning the design of the tool, which is discussed in Chapter 5.

Comparison of Codes and Themes

Codes and themes were used to categorize topics found in the CSU 2016 SLA questions and the results of the focus groups. The researcher was interested in knowing topics focus group participants identified as being related to the concept of sustainability and topics identified

within the dimensions of the TBL. The findings provided insight on what topics could be included on future assessment and a dataset of topics of sustainability.

Codes and Themes Developed from Assessment Tool

The codes and themes that were developed from the economic sustainability questions on the CSU 2016 SLA are shown in Figure 12. Five themes are listed at the top of the figure, with the related codes listed under the themes. After coding was completed it was observed that five of the ten economic questions related to income. Though income falls within the dimension of economic sustainability, the researcher believes there should be more variety of economic questions on a future assessment. The researcher recognizes personal bias may have influenced the questions selected for the assessment tool. Analysis also found many of the questions were are time-sensitive, which is discussed in greater detail in Chapter 5. Overall, analysis found there was not a wide breadth of economic topics in the questions on the CSU 2016 SLA.

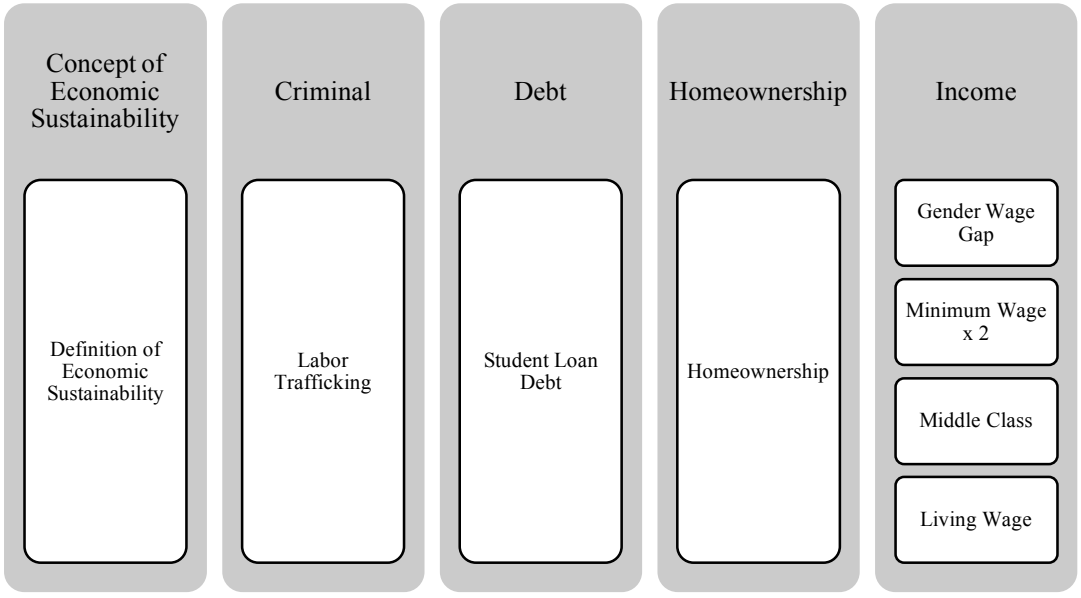

Figure 12. Economic Sustainability Themes with Codes Developed from Questions.

The five environmental sustainability codes and themes developed from the CSU 2016 SLA are illustrated in Figure 13 with the themes at the top, and each of the eight codes that

relates to the theme listed below. Of the five themes, one might argue that Emissions and Ozone could be grouped together, however the researcher believed it stood alone since the question that included the topic of Ozone was asking respondents to identify a definition, where the emissions-related questions were not. Analysis found each of the themes are topics of past CSU public lectures. This was not intentional, however there is a possibility those lectures influenced the development of the environmental sustainability questions. Because many of the lectures were given by CSU faculty, there is also a possibility the question topics are taught at CSU, which aligns with respondents' high scores on answering the environmental sustainability questions. Further analysis of CSU courses is needed to confirm this assumption.

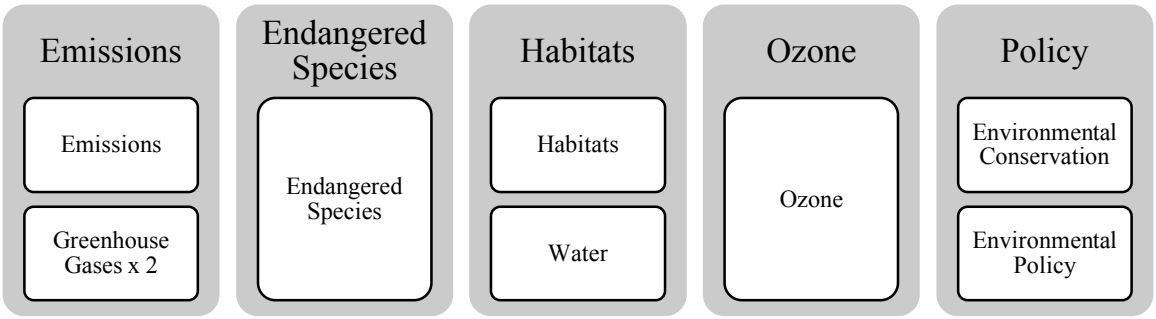

Figure 13. Environmental Sustainability Themes with Codes Created from Questions.

The social sustainability codes and themes developed from the CSU 2016 SLA are illustrated in Figure 14. Again, five themes are at the top, with ten codes listed below. As with the other dimensions, some of the themes only included one code, while others had more than one. Analysis found the codes and themes to be topics that are commonly discussed in national and local news. Additionally, they are topics addressed in CSU coursework, which implies the researcher was influenced to develop based on past coursework and it is assumed the question topics align with what CSU students are being taught in some courses.

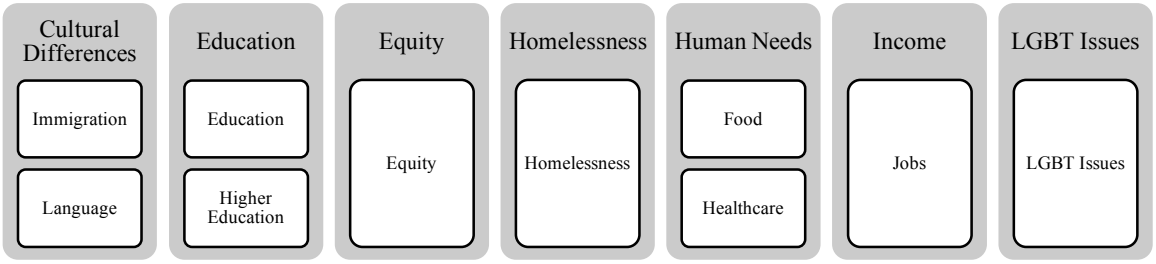

Figure 14. Social Sustainability Themes and Codes Created from Questions.

Codes and Themes Developed from Focus Groups

Codes and themes were developed from the data collected in the four focus groups. Focus groups are identified as Group 1, Group 2, Group 3, and Group 4. The codes developed from the transcribed audio recordings are reported separately by focus group, however codes developed from the participants' small sticky-notes (Appendix K) were grouped together. The groups' recordings were separated to show differences and similarities; however, few differences were found. Though each focus group discussed differing sustainability topics, all four and all participants, indicated their interest in sustainability education and students showed eagerness to learn more about sustainability across the TBL or across various systems.

Focus group participants were directed to think of words or phrases when they heard the word sustainability. Their responses were organized within the framework of the TBL since it is a common framework used by other IHE and at SoGES. Codes are shown with the number of focus groups in which they were discussed (Figure 15). Environmental sustainability codes (13) outnumbered social sustainability codes (5) and economic sustainability codes (4).

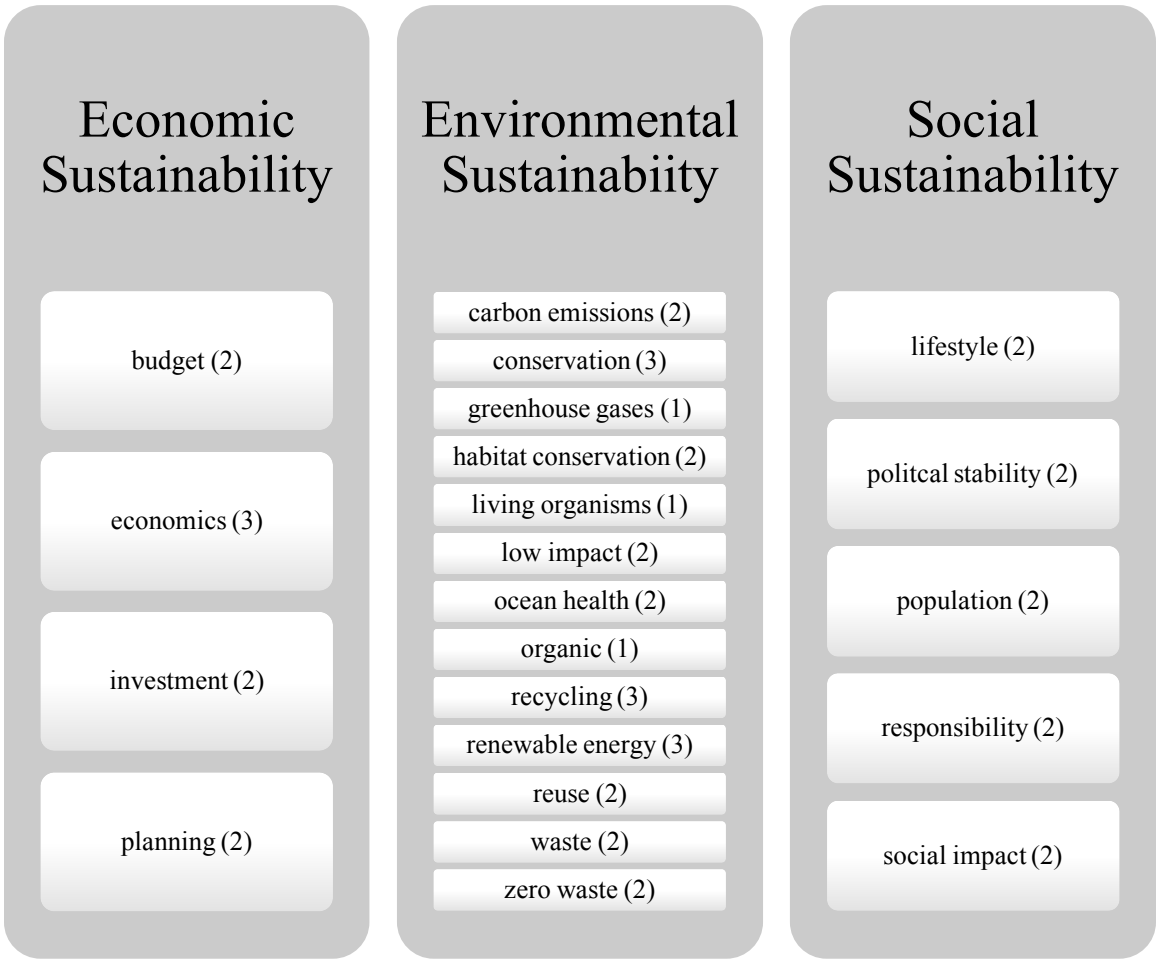

Figure 15. Concept of Sustainability Codes Within the Triple Bottom Line.

The economic sustainability codes and themes that emerged from the participants' responses crossed a variety of topics. Figure 16 shows the nine themes at the top, with the group of corresponding codes listed under. The results show participants identified various topics, and there were a number of themes identified in the focus groups, with the themes of "business" and "community" having prevalence in the economic dimension of the TBL. Observation of the focus groups found some of the students felt passionate about city development and specifically there were discussions over the city of Fort Collins' planning and growth. Students identified the importance of sustainable development and the challenges for it in a rapidly growing community. Another aspect of community that was discussed focused on lack of cultural diversity. Many

students were from Midwest states (e.g., Iowa, Illinois, Wisconsin) and expressed growing up in predominantly racially white communities with little cultural diversity. Students mentioned they knew more about sustainability because of their CSU education and time spent on campus and within Fort Collins. In addition to being topics discussed at CSU, there is breadth in the topics that cross the three dimensions of the TBL. For example, the economic dimension and environmental dimension are found under the theme of "Taxes" in the code "carbon tax". The purpose of the carbon tax is to influence carbon reduction in the environment.

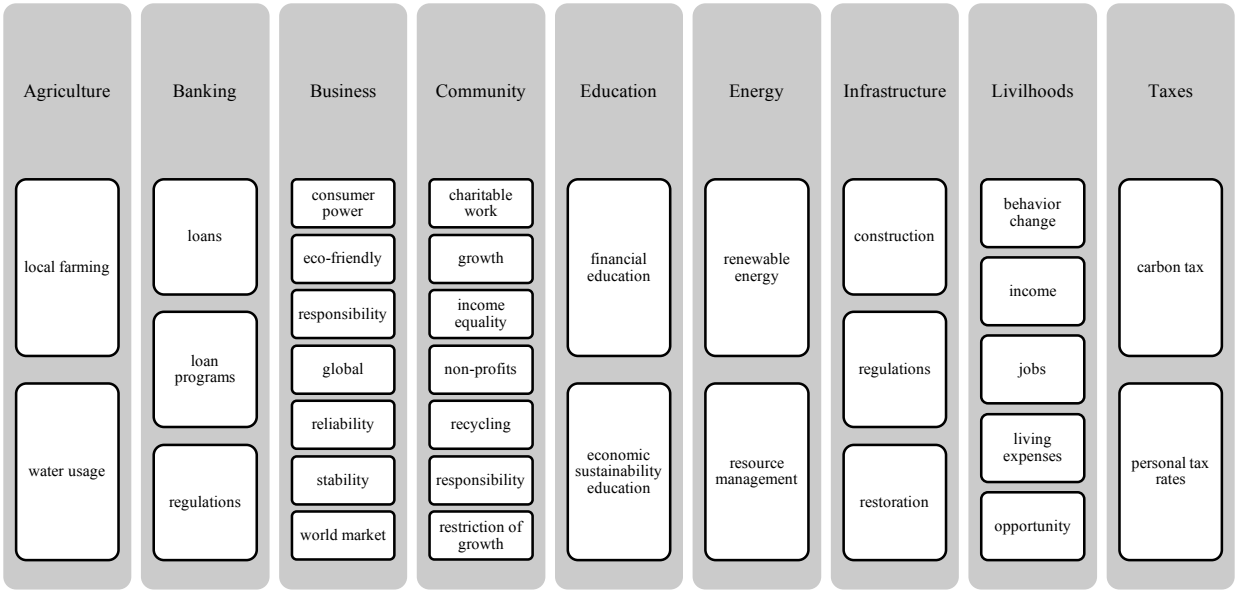

Figure 16. Economic Sustainability Codes and Themes Developed from the Focus Groups.

The environmental sustainability codes and themes from the four focus groups are shown in Figure 17. Due to the number of codes and themes the figure was designed for best display. Themes are listed at the top of each circle with codes listed below the themes in which they belong.

Analysis found the themes of "community", "land", and "resources" included the greatest number of codes. Again, these are topics that have been addressed in CSU lectures and panel discussions, which may indicate students were influenced by what they have learned at CSU.

More telling is the number of codes and themes, which aligns with CSU's history of addressing topics of environmental sustainability.

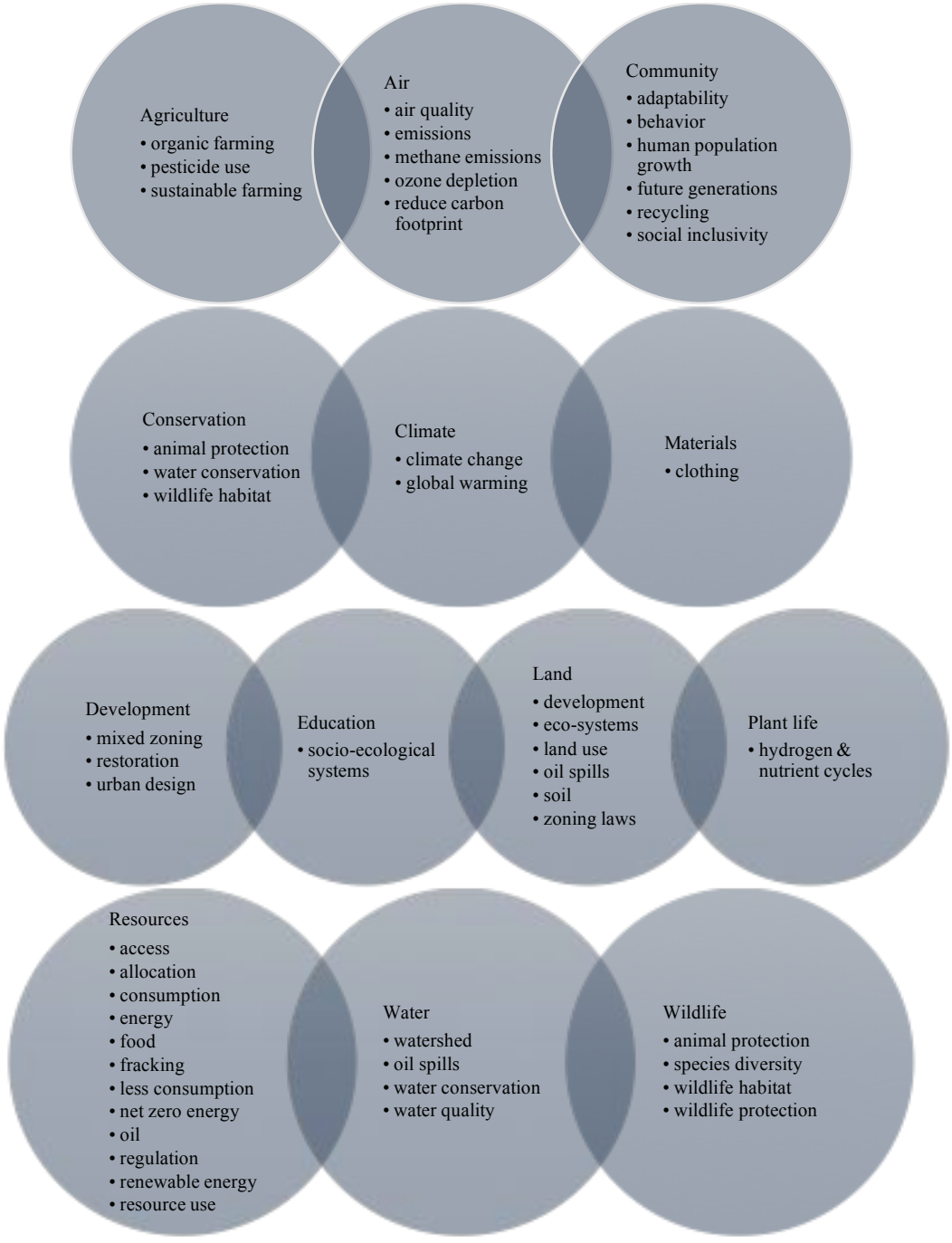

Figure 17. First Environmental Sustainability Themes and Codes Developed from Focus Groups

Social sustainability codes and themes from the four focus groups are illustrated in Figure 18, with themes at top and codes under. Again, participants thought of a variety of topics related to the social dimension of the TBL, with the most codes fitting under the themes of "community" and "people". Students often related discussions of sustainability with people, referring to people in their communities. Students also shared stories about their home communities and what they have learned since relocating to CSU. As students recalled and shared stories from their past, they influenced one another to share similar experiences, building rapport among participants.

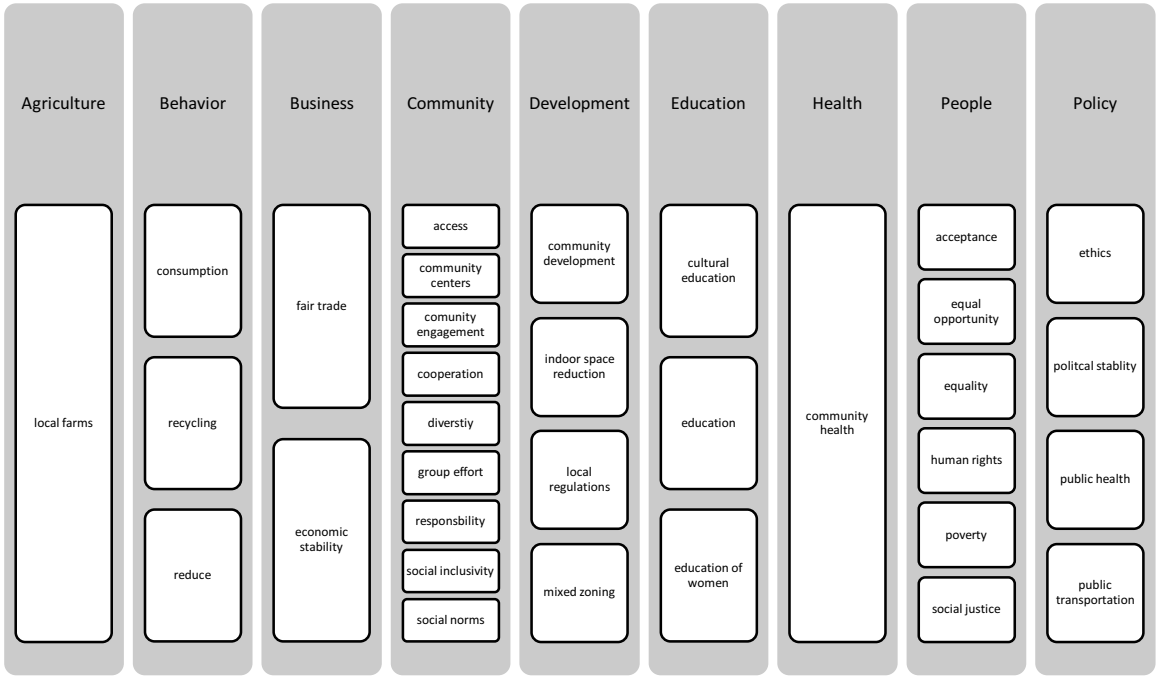

Figure 18. Social Sustainability Themes and Codes Developed from Focus Groups.

Word Clouds

Word clouds were created and analyzed to see the prevalence of words that stood out. Word clouds offered a quick analysis of key words from the focus groups. Due to the limited length of time needed to create word clouds, this method of analysis was selected and found to be beneficial in identifying key words and phrases. After each word cloud was created the recordings were re-played to allow for the researcher to reflect on the conversations. By

reviewing the word clouds while listening to the recordings, the researcher was able to identify the concept of systems thinking, which is discussed in detail in chapter 5.

The recordings produced helpful and interesting results. Each of the four focus groups addressed many different topics that crossed academic disciplines, supporting the argument that sustainability education is interdisciplinary. In focus group 4, one participant mentioned the "vastness of topics" that can be discussed when talking about sustainability, and the findings of this study aligned with that sentiment. For example, students in the first focus group discussed farming practices, in the second focus group participants discussed mixed zoning, the third focus group discussed food topics, and the fourth focus group participants discussed community engagement. The neat thing about the focus groups was that participants discussed topics and shared knowledge about the topics, which the researcher found to be meaningful for herself and the participants. For example, two female graduate students who studied nutrition shared information about the lack of enough fresh fish to feed the current human population. Of the topics discussed, each could easily fit within the model of the TBL, and be analyzed per dimension of the TBL.

. The word clouds developed from the focus groups are reported per focus group (Group 1, Group 2, Group 3, Group 4). Along with the word clouds, quotes from the focus groups are reported.

Across all four focus groups the participants discussed two main concepts related to sustainability, the importance of learning through experience and problem-solving, and the importance of understanding systems and biodiversity. Participants discussed the need for "hands-on" learning and for individuals to understand how systems work, such as connections

between social and environmental issues or economic and social issues. The most important findings from the two focus groups were:

1) to learn about the concept of sustainability, non-traditional teaching methods are best, as they provide students with real-life experience, as is found with the service learning approach discussed in Chapter 2.
2) the importance of systems thinking in understanding the concept of sustainability.

Group 1, key words, which stood out and were of importance were, sustainability, environmental, experience, social, cultural, practices, people, education, and change. Participants discussed various topics across the TBL including sustainable farming, workers' rights, and gender bias. For example, one student mentioned females missing from leadership roles in academia. Another student said he noticed some students assume science teachers are male due to the limited number of females working in disciplines, such as chemistry. Participants in group 1 discussed the importance of "hands on" education and working in the environment to learn about sustainability. One student shared his experience working on an organic farm and what he learned about sustainability and stated he "only got that education from working".

Participants had varying views on CSU's sustainability education, with some students saying their focus has been on environmental sustainability, but others saying their learning has addressed economic and social sustainability. These differences may be related to students' program of study. The most important highlight from the first focus group was that participants discussed the need for education to offer real-life experiences. For example, when discussing how to best teach environmental sustainability one participant stated, "the important way to educate people is to provide context, and the only way to do that is by immersing them in nature". The participant suggested it is important for people living in urban areas to have a

connection to nature and agriculture. Looking at the dimension of economic sustainability, one student proposed students should be educated on "how to make their personal finances more sustainable".

Figure 19. Focus Group #1 Word Cloud

The word cloud that was developed from Focus Group #2 is shown in Figure 20. Participants identified and discussed the connections of economic, environmental, and social sustainability. One topic discussed in great detail was the importance of community planning, such as using mixed zoning. One male graduate student expressed disappointment in construction around Fort Collins that did not follow the mixed zoning idea and shared with other participants the definition of mixed zoning and why it fits within sustainable development. He stated, "the idea of urban sprawl and suburbs in America just doesn't make sense".

This focus group addressed the importance of non-traditional education, as one participant argued that undergraduates should have to complete a sustainability-related research project their senior year. The participant explained "I honestly think there should be a senior thesis". Participants felt many of their CSU courses repeated the same information, with one student stating it was "like beating an old horse". The participants felt sustainability education

should be more innovative and focus on “real life” topics. One student argued the importance of students conducting “real contributions” to society to learn, and stated courses should be “problem-based”.

Figure 20. Focus Group #2 Word Cloud

The word cloud developed from Focus Group #3 is shown in Figure 21. The participants addressed the importance of understanding systems thinking in relation to the three dimensions of the TBL. Students explained they had learned about sustainability and systems thinking through student groups, such as the food and nutrition club, which often addresses food systems. One participant gave the example that the club has discussed “different types of farming”. She shared how the club hosts many educational events throughout the school year, including campus lectures “given by speakers from differing disciplines”.

Participants felt the need for more connections among the dimensions of the TBL in sustainability education. One student who studies song birds on ranches expressed “the ranchers are going to worry about habitat … grazing ability … and from an economic sustainability viewpoint, they have land but have to take care of the land.” In support of the Four Pillars of Sustainable Development (Waite, 2017), which includes the dimension of Future Generations,

one participant mentioned “it makes sense if you are talking about sustainability that you are thinking about long term”.

Figure 21. Focus Group #3 Word Cloud

The word cloud that was developed from Focus Group #4 is shown in Figure 22. In the fourth focus group there was emphasis on individuals’ understanding of systems in relation to policy and regulation as illustrated by words “community”, “systems”, and “impact”. The participants discussed the importance of community access to education about different resources, such as building materials and government policies. One participant explained the importance of public health, which she included both access to healthcare and the health of the environment. The participant said “government can really impact how clean our air and water are”. Relating to government and policy, another participant questioned, “thinking about more and more young people who graduated from college and can’t find employment or are underemployed, how does the current economic systems set people up to succeed, or not?”

Participants felt it was important that governments and private companies invest in sustainability, as "when you invest in sustainability you get more out of it … in the long run you get more money, use out of it". Another participant asserted "many unrenewable resources will not be available in the future", thus another important reason for sustainability education.

Figure 22. Focus Group #4 Word Cloud

It was observed in all four focus groups participants were passionate about discussing sustainability and many showed an eagerness to learn more, however participants also expressed they preferred learning that focused on real-life issues so they could "contribute to solving a problem". Participants continually mentioned that "real life" and "hands on" education was the best way they have learned about sustainability, and it is the most interesting too. Faculty should consider using non-traditional teaching methods, along with the inclusion of systems thinking to bridge connections among the dimensions of the TBL.

Awareness of Sustainability Education Opportunities

Both the respondents of the SLA and the participants of the four focus groups were asked their awareness of sustainability education opportunities. The responses to these questions indicate where CSU could improve marketing for certain sustainability education opportunities.

Just over half of the SLA respondents were aware of the minor in Global Environmental Sustainability, with fewer knowing about the Sustainable Water Interdisciplinary Minor, the Pre-college Summer Sustainability Program, or the SoGES Endorsed Courses (Figure 23).

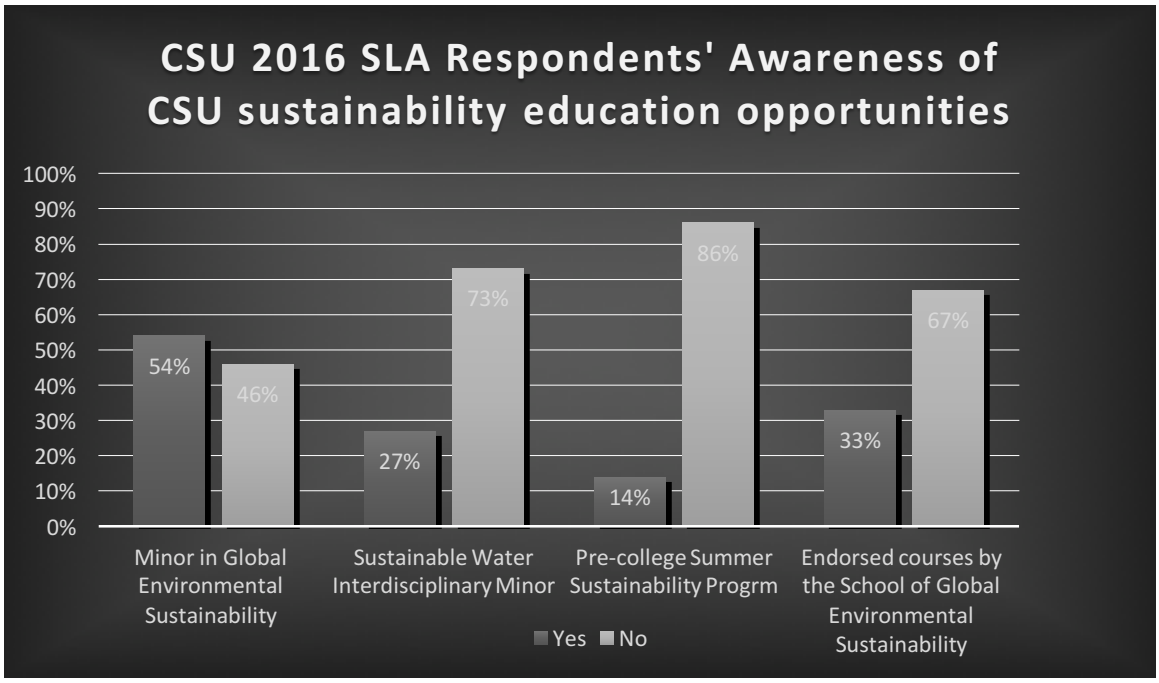

Figure 23. Respondents' Awareness of Sustainability Education Opportunities.

In contrast to the SLA findings, focus group participants reported they were aware of the minor in Global Environmental Sustainability and just over half were aware of endorsed courses offered by SoGES. Participants reported less awareness of the Sustainable Water Interdisciplinary Minor and the Pre-college Summer Sustainability Program (Figure 24).

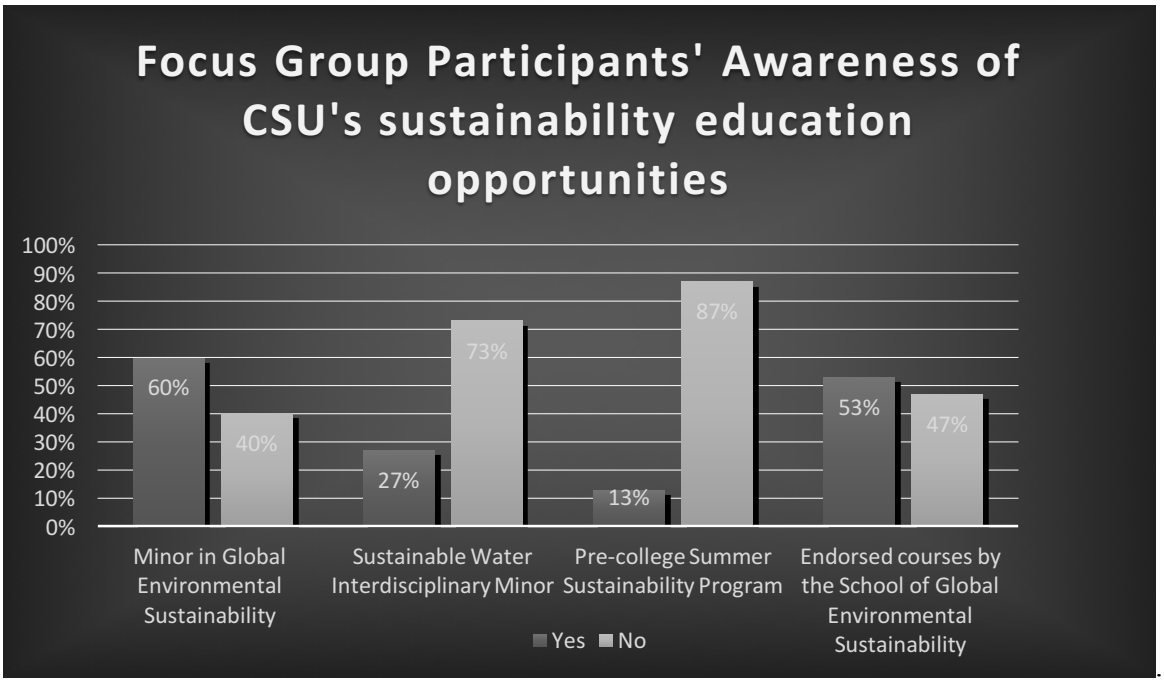

Figure 24. Participants' Awareness of Sustainability Education Opportunities.

Where Students Reported Learning about Sustainability

The researcher wanted to find out where students were learning about the concept of sustainability to inform CSU of its sustainability education initiatives.

Respondents of the CSU 2016 SLA reported learning about sustainability mostly in classes and from instructors (n = 230). Additionally, respondents reporting learning about sustainability through observing practices and artifacts around campus (n = 228), such as recycling bins and water bottle filling stations. Fewer respondents reported learning about sustainability from the Student Sustainability Center (n = 39), which is housed under SoGES, or from an Eco-Leader, referring to CSU's Housing & Dining Service's Eco-Leaders Program (n = 27) (Figure 25).

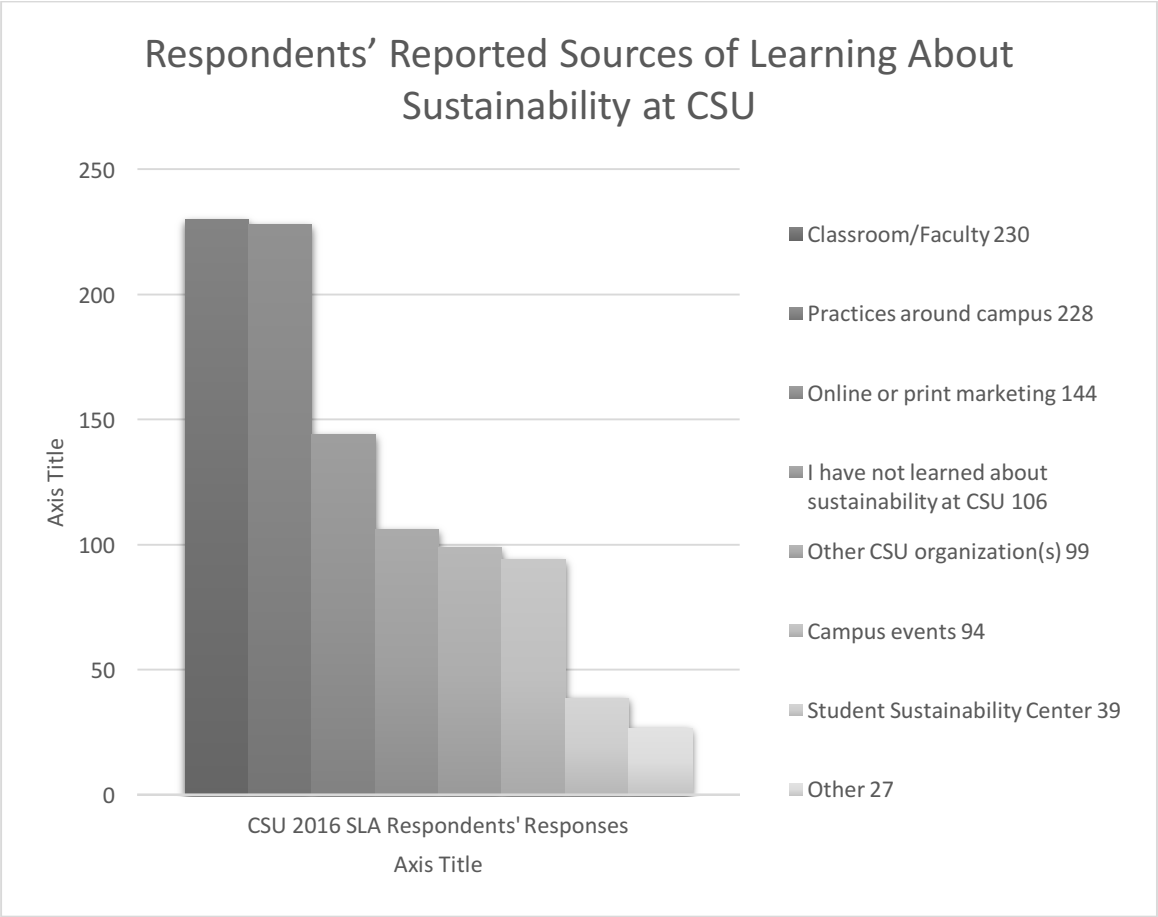

Figure 25. Respondents' Reported Sources of Learning About Sustainability at CSU.

On the short survey given at the beginning of each focus group, participants reported learning about sustainability mostly through observing practices and artifacts around campus (n = 10) and in classes (n = 9). Three participants reported learning about sustainability from the Student Sustainability Center. One participant reported learning about sustainability at a location other than the university, reporting learning from military experience. These results are shown in Figure 26.

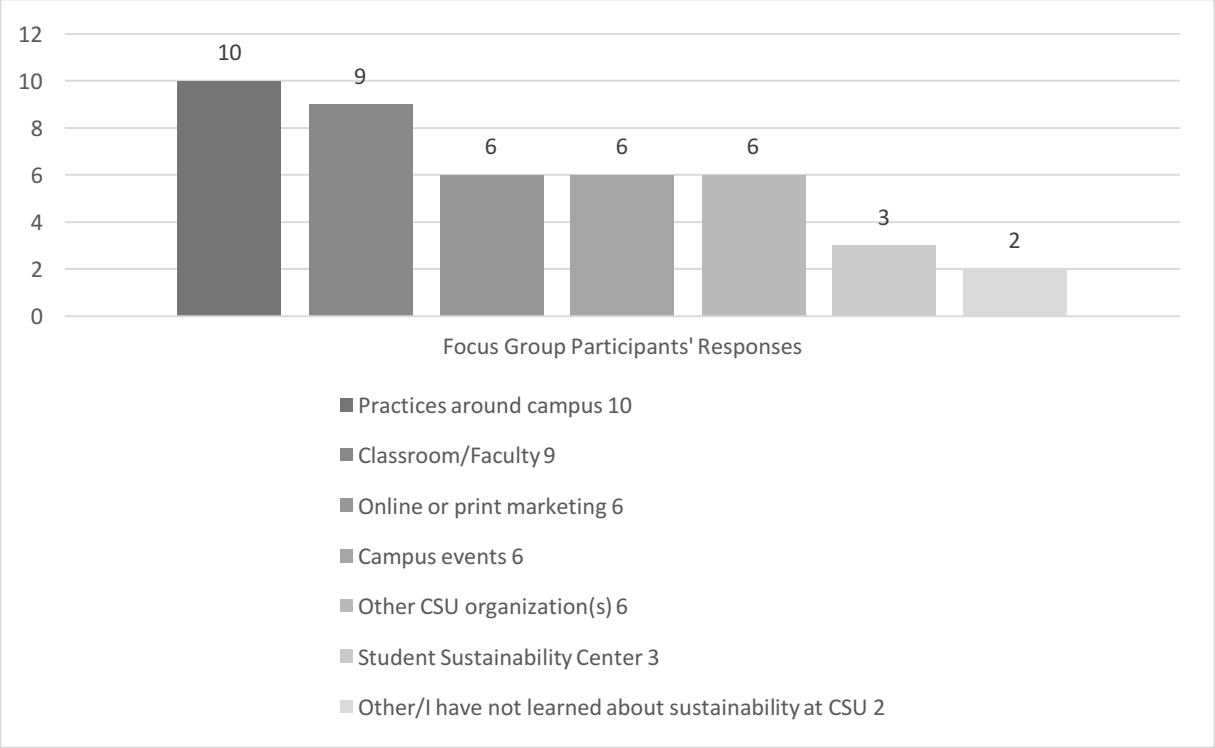

Figure 26. Participants' Reported Sources of Learning About Sustainability at CSU.

Summary

Overall, there was little difference in students' performance on the SLA based on academic level, college of enrollment, gender, or housing. Students performed best in environmental sustainability literacy, but showed need for improvement in economic and social sustainability literacy. These findings were supported by the findings of the four focus groups in which students reported learning and knowing more about environmental sustainability. The focus groups offered valuable findings to help CSU faculty and administrators make decisions regarding sustainability education. Most importantly, focus group participants found non-traditional learning to be useful in their understanding of sustainability and expressed the need to educate peers about economic, environmental, and social connections. As one participant shared, courses should focus on topics that are "relevant", but understand that many topics "overlap" other topics. To explain this overlap, another participant stated, "we are a community living

inside a society living inside the environment" … "each and every one of the [topics] relates to another one."

The findings provided insightful information to help CSU administrators make decisions regarding sustainability education, however the findings did not support an answer for the fourth research question, which asked what the strengths and weaknesses of using the TBL as the model for the CSU 2016 SLA. During analysis it was found the fourth research question was more difficult to answer and the study's design did not actually test the use of the TBL. Although data did not offer a clear answer to Research Question #4, it was the missing data that led the researcher to an aha! moment. Being stuck at this question offered an opportunity to take a step back and review all of the data collected. From this analysis an important finding presented itself. Building from the findings of the four focus groups, where the constructs of non-traditional learning and systems thinking emerged, the researcher thought back to the review of literature, which identified that sustainability literacy is ultimately about individuals taking action to build a more sustainable world. Therefore, the most important finding from the study was the lessons learned, which are discussed in Chapter 5.

CHAPTER FIVE: DISCUSSION

> When we try to pick out anything by itself, we find it hitched to everything else in the Universe.
>
> - John Muir, *My First Summer in the Sierra*, *1911*

The study's purpose was to analyze students' performance on a sustainability literacy assessment, referred to as the CSU 2016 SLA. When the study originally began the researcher was new to the topic of sustainability literacy and designed the assessment tool similar to those created at other IHE, with many published on the AASHE website, such as one developed at Ohio State University in collaboration with the University of Maryland (Zwickle et al., 2013). Based on findings from the review of literature and focus groups, it was determined that a knowledge-based multiple-choice assessment tool was not the right approach to assessing sustainability literacy. The researcher experienced many reflection and aha! moments, and it was within those moments that questions about the design of the CSU 2016 SLA emerged. Ultimately, if the researcher were to conduct another assessment on students' sustainability literacy, the tool would be designed with the inclusion of systems thinking, which means a simple multiple-choice design would not work. Instead, a question style that might be appropriate for a sustainability literacy assessment is the evaluation question. "An evaluation question asks the reader to decide whether he or she agrees with the author's ideas or point of view in light of his or her own knowledge, values, and experience" (Evaluation Question Prompts, n.d., p. 1). However, if the multiple-choice method was preferred, sustainability literacy could be assessed through a sophisticated multiple-choice tool.

The TBL is a commonly used model to describe the concept of sustainability. However, there are many other models, as one student explained she was more familiar with the model of

"a community in a society in an environment". IHE should select a model based on what their education addresses. The TBL works for CSU, but another model might be more suited for other institutions. This is something administrators and educators at IHE should determine together to find what works best for their institutions.

Lessons Learned

Data collection began in Spring 2016 with the distribution of the CSU 2016 SLA. The focus groups were conducted in Spring 2017. Reflecting back, the data collected from the focus groups offered the greatest insights on understanding students' sustainability literacy. Since the focus groups were conducted a year after the CSU 2016 SLA was distributed, their perceptions were not used to develop the assessment tool, however now they should be used to inform the development of a new sustainability literacy assessment tool. To accurately assess students' sustainability literacy, there are other components, such as the higher levels on Bloom's Taxonomy, than knowing the correct answers to multiple-choice questions. Sustainability literacy is about individuals knowing about a sustainability problem and taking action to solve the problem.

While literature on teaching the concept of sustainability discusses the importance of students understanding the connections among economic, environmental, and social dimensions (Winter & Cotton, 2012), it emphasizes the need for sustainability education to use "more active learning strategies that involve student-centered teaching and examination of real-life problems" (Locke, Russo, & Montoya, 2013, p.3). Therefore, IHE should look at how they are teaching the concept of sustainably and examine the expected learning outcomes of the courses, and then assess students to determine if course objectives are being met. IHE should seek to move sustainability education from theory to action (Nolet, 2009), which is why the researcher of this

study recommends that a sustainability literacy assessment be designed based on Mezirow's transformational learning theory using Bloom's Taxonomy (Bloom, 1956) to achieve a valid assessment of students' sustainability literacy. Also based on the findings, sustainability literacy is dependent on abilities of individuals to use systems thinking to understand sustainability.

Applying Systems Thinking to the Concept of Sustainability

Sustainability literacy assessments should include questions that are based on the use of systems thinking as it is a way of thinking and analyzing problems that take into consideration all dimensions of the problems. It "focuses on how the thing being studied interacts with the other constituents of the system, a set of elements that interact to produce behavior, of which it is a part" (Aronson, 1996, p. 1). This way of thinking

> emerged from a series of interdisciplinary dialogues among biologists, psychologists, and ecologists, in the 1920s and '30s. In all these fields, scientists realized that a living system - organism, ecosystem, or social system - is an integrated whole whose properties cannot be reduced to those of smaller parts. (Capra, 2009, p. 245)

The use and approach of systems thinking is ideal for understanding the concept of sustainability, and it is often referenced by those working in ecology and eco-literacy (Capra, 2007; Orr, 2004), who have voiced the need for teaching the concept of sustainability from a systems thinking approach.

> The character of systems thinking makes it extremely effective on the most difficult types of problems to solve: those involving complex issues, those that depend a great deal dependence on the past or on the actions of others, and those stemming from ineffective coordination among those involved. (Aronson, 1996, p. 1)

Because systems thinking encourages individuals to think "in terms of relationships, connectedness, and context" (Capra, 2007, p. 12), it is essential students have a foundational understanding of systems thinking, in combination with a knowledge framework for the concept

of sustainability, such as the TBL. However, in the end, the framework used is less important than the ability to understand how the dimensions are connected.

Transformational Learning in Sustainability Education

Research on sustainability literacy should look to Mezirow's transformational learning theory for guidance. Over the decades, theorists, including Mezirow, have critiqued and revised the theory (Kitchenham, 2008), which refers to individuals "experiencing a deep, structural shift in basic premises of thought, feelings, and actions" (The TLC Approach to Transformational Learning, n.d., para. 1). This theory can help sustainability educators identify how students experience a "structural shift". For example, would a senior college student be able to solve a problem more thoughtfully than a freshman college student? Using this theory was supported through a review of literature, which identified there are researchers studying sustainability education who are using Mezirow's theory and findings to develop effective sustainability learning methods (Moyer & Sinclair, 2016; Quinn & Sinclair, 2016).

Interpretation of the Assessment Tool Results

Findings determined the design of the CSU 2016 SLA did not effectively assess sustainability literacy, and thus was not an appropriate tool to measure students' sustainability literacy. The results of the assessment provide the university with data about what students know in relation to topics that are often addressed within the context of sustainability, but the assessment tool did not provide meaningful results in regards to students' sustainability literacy performance based on the definition of sustainability literacy. However, the data from the 2016 assessment provides valuable findings for CSU.

CSU 2016 SLA respondents performed highest in environmental sustainability by correctly answering more environmental sustainability questions and scored the lowest on the

social sustainability questions. There was little difference in performance based on demographics. Students most commonly learned about sustainability from faculty and in their classes, and from practices around campus, such as bottle-refilling stations and recycling bins. This suggested that sustainability education at CSU is geared toward environmental sustainability as was expected, especially considering the name of the sustainability school includes “environmental”. In addition, CSU has a long history of offering education and research focused on environmental conservation.

Time-Sensitive Questions

Through analysis of the questions on the CSU 2016 SLA, it was observed that some questions were time-sensitive. The researcher’s doctoral advisor recommended these questions be revised, to limit the number of times the assessment tool questions would need to be edited due to the changing information. Additionally, based on the findings from the literature and findings from the study, it is less important that individuals know numbers and statistics as facts and more important they know and understand the concept of sustainability, have the ability to conduct systems thinking, and understand the connections among the three dimensions of the TBL. The questions illustrated in Figure 27 were determined to be time-sensitive and were removed from the assessment tool when revising the CSU 2017 SLA version. The identified time-sensitive questions from the dimensions of economic sustainability included Q19 - Q22, Q26, Q29 - Q31 (Figure 27).

Figure 27. Time-Sensitive Questions.

Limitations to the Study

A limitation to the study was not using multiple coders to analyze the qualitative data developed from the questions asked on the CSU 2016 SLA and from the four researcher-led focus groups. Because of this, the identified codes and themes were based on the researcher's understanding of various topics without confirmation by others.

Analysis of the questions included on the CSU 2016 SLA discovered Question #15 to be an opinion-based question that could be considered biased. Additionally, this question only included three response options, and those who responded with 1) Yes were directed to Question #16. This was considered a limitation because not all respondents were given the opportunity to respond to Question #15 (gender pay gap), which is why responses from Question #14 (belief in gender pay gap) and Question #15 were not analyzed when scoring.

Another limitation was that focus group participants were not asked to rate their level of sustainability knowledge as were the respondents to the CSU 2016 SLA. Initially, focus group

participants were not asked this question since they were not taking the assessment. However, later, through researcher reflection, it was determined this information would have been useful as this data would have provided a comparison between the respondents and participants, which might have offered interesting findings considering the age differences and time at CSU found between the two.

Recommendations for Future Research

When this study began, the researcher was focused on assessing sustainability literacy, however the findings led the researcher to consider sustainability education teaching and learning methods. The four focus group findings were most useful in coming to this conclusion. They provided insightful information for revising the CSU 2016 SLA, and provided information for educators teaching topics of sustainability. The findings highlighted the importance of students being able to use systems thinking and for students to understand the complexity involved with sustainability. The findings also indicate educators should use non-traditional approaches to teaching the concept of sustainability, which coincides with recognition of individuated styles of learning among college students (Cheng & Chau, 2016; Power & Farmer, 2017). Overall, the findings show there is a lot to think about in regard to assessing sustainability literacy and teaching and learning the concept of sustainability.

Combining these two ideas, it is recommended that research conducted on college students' sustainability literacy look at the teaching and learning approaches used for the concept of sustainability. Additionally, creating an assessment tool based on methods used to teach the concept of sustainability will provide more accurate data for understanding students' learning outcomes. For example, if courses are focusing on problem-based learning, the assessment tool should include questions that are problem-based. However, one obstacle is that not all students

take the same courses, therefore, IHE might want to consider a group of students' who have taken selected courses instead of doing a campus-wide assessment.

Another idea is that researchers look at other creative techniques to collect data, instead of a traditional assessment tool, such as an online survey. The researcher believes it would be beneficial for IHE to consider using various assessment approaches. For example, observations of students' behavior on campus and individualized assessments based on academic discipline, because sustainability literacy is more than knowledge, it also involves action. Educators should know students' behaviors outside of the classroom.

Finally, to address the fourth research question, which asked if the TBL was the best model to use to assess sustainability literacy, the findings did not accurately answer the question. However, the researcher believes it would be beneficial to IHE if multiple models were tested to determine the most accurate model for explaining the concept of sustainability. One thing to consider when determining models to use, is the teaching and learning methods used to teach sustainability.

Final Considerations Based on Findings

It is recommended that CSU randomly select courses that claim to address the concept of sustainability and conduct a study to determine the teaching methods and frameworks used in the courses, along with expected student learning outcomes. Having this information will allow the University to determine if sustainability education initiatives align with the definition of sustainability literacy (Nolet, 2009). Additionally, questions should be designed to include the concept of systems thinking, which may mean word questions or complex multiple-choice questions. Finally, it is recommended that CSU select a random sample of students who are enrolled in these courses and assess their sustainability literacy using pre- and post- assessments.

These recommendations, combined with those made above regarding the assessment tool design, will allow CSU to accurately report students' sustainability literacy levels.

As sustainability education grows throughout higher education, it is important for IHE to be willing to invest time and money to develop an accurate and sustainable assessment tool. To provide data over a long period of time, IHE should use an assessment tool that can be used each year or twice per year if planning to give a pre- and post- assessment. Since the concept of sustainability crosses disciplines, it is important that different academic units at an institution work together in the development of an assessment tool. This might be through a collaborative committee that refines and approves the assessment, or through a teamwork approach in the development process. In the end, however an institution decides to assess students' sustainability literacy, the important thing is that some form of assessment takes place. If IHE are promoting their commitment to sustainability and their sustainability education, there needs to be an accurate assessment of learning, and if outcomes are being reached. Ultimately, a sustainability literacy assessment must test students' knowledge along with their willingness to take action in their communities.

Epilogue

I completed this manuscript in late April 2017 and it was successfully defended on May 1, 2017. After defending, I spent the summer working on editing the manuscript and thinking about the findings. In late August I received a request from the University of Toronto Sustainability Office to discuss the assessment tool and processes taken at CSU. I happily accepted the offer and spoke with a student employee who was researching what other IHE were doing to assess students' sustainability literacy. Through that conversation I learned that they too felt the current multiple-choice model of assessment was lacking meaning. I was excited to learn

this, as this meant others were coming to the same conclusion I had come to in my study. Using a knowledge-based multiple-choice assessment does not capture meaningful results. How can an assessment tool designed like this assess students' ability to apply systems thinking, conduct critical-thinking and problem-solving, or determine behavior?

Related to sustainability education and designing a valid assessment tool, I believe it is important for AASHE and sustainability educators take a step back and think about what it is we want students to know. What should the sustainability literacy assessment be asking? What do we really need to know? From my research, I believe we want to understand what students are doing outside of the classroom, instead of their performance on a test. We want to know what students know, what they do with that knowledge once they have it, and what they plan to do in the future. It might be more beneficial for IHE to develop a three-step assessment. The first step of the assessment would be a traditional assessment tool given to incoming students (e.g., freshman, transfer students) to determine what students know, in the second step the same assessment tool would be used to assess graduating students to find out what they know, and in the third step an assessment, possibly in the form of a questionnaire, should be given to alumni to find out how they are living sustainability personally and professionally.

However, in addition to assessing students, I also believe IHE need to know how they are teaching sustainability to students. Is there a consistent method across campus? What are the topics students are being taught? Institutions will need to invest time and money into being able to answer these questions, which may be complex considering how interdisciplinary sustainability is, however, in the end it is information that would be worthwhile and meaningful. Ultimately, that is what IHE and educators need to come back to - is the teaching and learning

meaningful? Thus, when an assessment is conducted, are the results of that assessment meaningful, indicating sustainability literacy?

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APPENDIX A: COLORADO STATE UNIVESRITY SUSTAINABILITY LITERACY ASSESSMENT

*The CSU 2016 SLA was developed based on a review of questions on the Eco-leaders Eco-literacy Assessment (2014) and from the Assessment of Sustainability Knowledge (Zwickle et al., 2013).

Thank you for your participation in the CSU Sustainability Survey!! Please look for the next CSU STARS report to see the results. To access all of CSU's STARS results visit https://stars.aashe.org/institutions/colorado-state-university-co/report/

**correct answers in italics*

Start here:

1. Using the scale below rate your perceived knowledge of sustainability. Select one number.
   1 represents low knowledge of sustainability and 10 represents high knowledge of sustainability.

   1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10

Select the one best response for each question.

Sustainability:

2. Which is the most commonly used definition of sustainability:
   a. Creating a government welfare system that ensures universal access to education, healthcare, and social services
   b. Setting aside resources for preservation, never to be used `
   c. *Meeting the needs of the present without compromising the ability of future generations to meet their own needs*
   d. Building a neighborhood that is both socio-demographically and economically diverse
   e. I do not know

3. Environmental quality and social equity are as important as economic stability; this is called:
   a. Sustainable development
   b. Acceptable business strategy
   c. Decision making for sustainable living

d. *Triple bottom line*
e. I do not know

Environmental sustainability:

4. The term "carbon footprint" is a measure of:
    a. The size of the carbon chain in a given quantity of gasoline
    b. Toxic carbons released in the air
    c. *Greenhouse gases released by burning fossil fuels*
    d. Carbon created by human footprints
    e. I do not know

5. Ground level ozone (bad ozone) is most often caused by:
    a. *Emissions from industrial facilities and motor vehicle exhaust*
    b. Chemicals from aerosol and other spray cans
    c. Methane gases from landfills and cattle exhaust
    d. Air traffic exhaust
    e. I do not know

6. The Life Cycle Assessment is a tool that evaluates the:
    a. Age of a society
    b. *Environmental impact of a product or service system from conception to end of use*
    c. Damage a product might have on the environment
    d. Changes in human life expectancy
    e. I do not know

7. Carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons are all:
    a. Atmospheric gases
    b. Gases produced by humans
    c. Gases important to control global warming
    d. *Greenhouse gases*
    e. I do not know

8. The majority of endangered species are at risk due to:
    a. Overhunting of exotic animals for their tusks, horns, etc. in their natural habitats
    b. *Human activities, natural habitat loss, climate change, and the introduction of non-native species to ecosystems*
    c. Issues with inbreeding due to people wanting purebred pets
    d. Disease and illness not adequately controlled
    e. I do not know

9. What does ozone protect humans from:
    a. Asteroids and other space matter
    b. Skin cancer

c. Overheating of the Earth
d. *Harmful ultraviolet rays*
e. I do not know

10. Which best describes stormwater:
    a. *Rain and snowmelt flowing over land, accumulating pollutants*
    b. Storm waste
    c. Acid rain
    d. Water collected from rain storms that people are allowed to keep for their personal use
    e. I do not know

11. The organization that oversees environmental regulations:
    a. *Environmental Protection Agency (EPA)*
    b. The White House
    c. State governments
    d. Federal Pollution Control (FPC)
    e. I do not know

12. Climate change creates:
    a. Nicer weather in cold locations
    b. Human illnesses
    c. Conflict between humans
    d. *Loss of habitats*
    e. I do not know

Economic sustainability:

13. Which of the following is a general definition of economic sustainability:
    a. Sustaining the current state of the country's economy
    b. *Ability to support a defined level of economic production indefinitely*
    c. The idea that everyone should earn a middle-class income
    d. Continued profit growth
    e. I do not know

14. Is there a wage gap in the U.S. between women and men:
    a. *Yes (Go to question 15)*
    b. No (Go to question 16)
    c. I do not know (Go to question 16)

15. What is the wage gap in the U.S. between women and men:
    a. Men make 5% more than women each year
    b. *Women make 21% less than men each year*
    c. Women make 50% less than men each year
    d. Men make 10% less than women each year
    e. I do not know

16. Which most accurately describes "living wage" in a given location:
    a. Minimum wage to support one's cost of living
    b. *Hourly wage that, at a minimum, supports a standard of living above the poverty level*
    c. Minimum wage a person can be paid
    d. Hourly wage paid based upon a person's qualifications
    e. I do not know

17. Most minimum wage workers are employed in which industry:
    a. Childcare
    b. Customer Service/Telemarketing
    c. *Food Service*
    d. Manufacturing
    e. I do not know

18. Student loan debt in the U.S. is around:
    a. *$1.1 trillion*
    b. $500.6 billion
    c. $600.8 million
    d. $5.5 million
    e. I do not know

19. The U.S. federal minimum hourly wage is currently:
    a. *$7.25*
    b. $9.25
    c. $6.50
    d. $8.00
    e. I do not know

20. Roughly what percentage of Americans identify as middle class:
    a. 20
    b. 42
    c. 52
    d. *87*
    e. I do not know

21. Approximately what percentage of U.S. citizens are homeowners:
    a. 76
    b. *65*
    c. 25
    d. 44
    e. I do not know

Social sustainability:

22. Victims of labor trafficking often work in which industry:

a. Dance shows, musical shows, carnivals
b. Escort services, dating services
c. *Agriculture, domestic work, health and beauty services*
d. Construction, car sales, yard work
e. I do not know

23. What is a "food desert":
    a. *Urban or rural areas without ready access to fresh, healthy, and affordable food.*
    b. Area where food is not grown due to climate, therefore all food must be shipped in
    c. Food that has been deemed unacceptable for human consumption
    d. A large compost bin
    e. I do not know

24. In the U.S., K-12 public school students who do not speak English have the right to:
    a. Be taught only in their native language
    b. Request the use of a mentor or tutor
    c. There are no specific rights for non-English speakers
    d. *Be taught English and provided with bilingual instruction*
    e. I do not know

25. Half of all U.S. undergraduate students attend:
    a. *Community Colleges*
    b. Public State Universities
    c. Private Colleges
    d. Online Universities
    e. I do not know

26. The U.S. Department of Health and Human Services describes medically underserved areas/populations where:
    a. There are no hospitals for people to gain access to major surgeries
    b. Care is expensive to tax payers
    c. *Too few primary care providers, high infant mortality, high poverty*
    d. Outdated medical equipment is used
    e. I do not know

27. What is an accurate statement about food security in the U.S.:
    a. Food security is not an issue
    b. *African American households are more than twice as likely to be food insecure as white, non-Hispanic households*
    c. This is an issue that affects those that live in rural areas that have dry, hot climates
    d. Elderly, homeless, and members of the LGBT population are twice as likely to be food insecure as other Americans
    e. I do not know

28. About what percentage of homeless teens identify as LGBT:
    a. *40*
    b. 10
    c. 90
    d. 75
    e. I do not know

29. What percentage of the U.S. adult population has at least a bachelor's degree:
    a. 55
    b. 45
    c. *29*
    d. 88
    e. I do not know

30. Unauthorized immigrants make up approximately what percentage of the U.S. labor force:
    a. 25
    b. *5*
    c. 50
    d. 10
    e. I do not know

About you:

31. What is your current academic level:
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. Graduate Student/ Professional/Vet Med Student
    f. Other _____

32. Are you enrolled as an international student:
    a. Yes
    b. No

33. How do you describe yourself:
    a. African American or Black
    b. Alaska Native
    c. American Indian or Native American
    d. Asian
    e. Biracial or Multiracial
    f. Hispanic or Latino/a
    g. Middle Eastern
    h. Pacific Islander

i. White or Caucasian
j. Other (if not described above): _____
k. Prefer not to answer

34. What is your age: (Drop box options)

35. How do you identify:
a. Female
b. Male
c. Transgender
d. Gender nonconforming
e. Other: _____
f. Prefer not to answer

36. Do you live in university-sponsored housing:
a. Yes
b. No

37. Select the college of your major/program where you are a student:
a. Agricultural Sciences
b. Business
c. Engineering
d. Health and Human Sciences
e. Liberal Arts
f. Natural Resources
g. Natural Sciences
h. Veterinary Medicine & Biomedical Sciences
i. Undeclared student
j. Other:_____
k. I do not know

38. Are you aware of the following CSU sustainability educational opportunities:
a. Minor in Global Environmental Sustainability YES NO
b. Sustainable Water Interdisciplinary Minor YES NO
c. Pre-college Summer Sustainability Program YES NO
d. Endorsed courses by the School of Global Environmental Sustainability YES NO

39. Where have you learned about sustainability at CSU? (Select all that apply)
a. Classroom/Faculty
b. Online or print marketing
c. Student Sustainability Center
d. Other CSU student organization(s)
e. Campus event(s)
f. Practices around campus (recycling bins, compost bins, water bottle filling stations, etc.)

g. Other:_____
h. I have not learned about sustainability at CSU

40. We are interested to know more about your thoughts on sustainability education at CSU and hope you will agree to join us in conversation through interviews or focus groups. To participate please provide your name, contact information, and best time to reach you. A Ph.D. student who is conducting research on sustainability education will contact you with further details in early 2016. Your contact information will not be shared in any other way.

a. Yes, I am interested in participating in conversation about sustainability education in either a focus group or interview: (go to C)
b. No, I am not interested in participating: (go to End of Survey)
c. Your name:
   Best contact method:
   Best time to contact:

APPENDIX B: ECO LEADERS ECO LITERACY ASSESSMENT

Eco Literacy Assessment
2014

Name: _____
Date: _____

Please answer the following questions to the best of your ability:

1. Producing the plastic in a single bottle from virgin plastic (not recycled) requires _____ the amount of energy to make the same bottle from recycled plastic taking into account all related processes.
    - Almost no energy compared to
    - Half
    - Equal
    - More than eight times
    - Do not Know

2. Social Responsibility implies a commitment to triple bottom line reporting, which includes:
    - Three forms of economic reporting
    - Environmental, social and economic performance
    - Multiple employee performance
    - All of the above
    - Do not know

3. Which of the following best defines social justice?
    - The concept of creating an inclusive society that is based on principles of equality
    - Laws that have been created on a national level to guide appropriate social behaviors
    - Appropriate punishment for those who commit hate crimes
    - Fighting crime in tights
    - Do not know

4. A technique to assess environmental impacts associated with all the stages of a product's life from cradle to grave (resource extraction through usage and disposal), is called:
    - An annual review
    - A life cycle assessment
    - An energy audit
    - A thermal system analysis
    - Do not know

5. What is meant by the term "carbon footprint"?
    - It refers to the size of the carbon chain in a given quantity of gasoline
    - The carbon left on the ground each time you take a step
    - Quantifying greenhouse gasses released by daily activities
    - All of the above
    - Do not know

6. Which of the following is a renewable resource?
    - Oil
    - Natural Gas
    - Trees
    - Coal
    - All of the above
    - Do not know

7. Which of the following statements about greenhouse gases is FALSE?
    - Humans would be better off without greenhouse gasses
    - Greenhouse gasses allow solar radiation in the atmosphere
    - There are many different greenhouse gasses, not just carbon dioxide
    - All of the above are TRUE
    - Do not know

8. What is the largest contributor to greenhouse gasses at CSU?
    - Transportation
    - Electricity
    - Solid Waste
    - Refrigerants
    - Methane from livestock
    - Do not know

9. The Urban Heat Island Effect is:
    - An increased desire to live in rural areas
    - An increased number of islands being discovered in tropical zones
    - An increase in the number of cities that cut off exports and imports during hot summer months
    - A rising temperature in urban areas due to the density of buildings and other human-made structures
    - All of the above
    - Do not know

10. Which of the following are principles of systems thinking?
    - Measuring outcomes within the larger, more complex system
    - Addressing problems in a way that does not create new problems in the future
    - Considering the impact of actions beyond environmental, economic and social to also include time and space
    - All of the above
    - Do not know

11. What does LEED stand for?
    - League of Engineers for Environmental Disasters
    - Learning and Experiencing Environmental Disciplines
    - Leadership in Energy and Environmental Design
    - Learning Enriched Environmental Dialogues
    - Do not know

APPENDIX C: 2014 SUSTAINABILITY LITERACY ASSESSMENT TOOL

Section I: The following questions relate to your knowledge on sustainability:

1. Which of the following is the most commonly used definition of sustainable development?
   a. Creating a government welfare system that ensures universal access to education, healthcare, and social services
   b. *Meeting the needs of the present without compromising the ability of future generations to meet their own needs*
   c. Setting aside resources for preservation, never to be used
   d. Building a neighborhood that is both socio-demographically and economically diverse
   e. I do not know

2. What is meant by the term "carbon footprint"?
   a. The size of the carbon chain in a given quantity of gasoline
   b. The carbon left on the ground each time you take a step
   c. Greenhouse gasses released by burning fossil fuels
   d. How carbon is measured
   e. I do not know

3. Please indicate if each of the following is a renewable energy resource?
   a. Oil
      i. Yes
      ii. No
   b. Geothermal
      i. Yes
      ii. No
   c. Trees
      i. Yes
      ii. No
   d. Coal
      i. Yes
      ii. No
   e. Wind
      i. Yes
      ii. No
   f. Solar
      i. Yes
      ii. No
   g. Nuclear
      iii. Yes
      iv. No
   h. Moving Water
      iii. Yes

iv. No

4. Ground level ozone (bad ozone) is most often caused by:
   a. Aerosol and spray cans
   b. Methane gases from landfills and cattle
   c. *Emissions from industrial facilities and motor vehicle exhaust*
   d. Air traffic
   e. I do not know

5. Please indicate which of the following you are able to recycle on the CSU campus?
   a. Paper products (newspaper, printing paper)
      i. Yes
      ii. No
   b. Plastic bags (shopping bags)
      i. Yes
      ii. No
   c. Aluminum cans (soda cans, soup cans)
      i. Yes
      ii. No
   d. Plastic bottles (soda bottles, water bottles)
      i. Yes
      ii. No
   e. Cardboard (moving boxes, pizza boxes)
      iii. Yes
      iv. No
   f. Glass bottles (beer bottles)
      iii. Yes
      iv. No

6. The Life Cycle Assessment is a tool that evaluates the:
   a. Age of a society
   b. Environmental impact of a product or service system from conception to end of use
   c. Damage a product might have on the environment
   d. Human life expectancy
   e. I do not know

7. Carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and ozone are all:
   a. Gases found on Mars
   b. Greenhouse gases
   c. Okay for humans to breath
   d. Needed to control global warming
   e. I do not know

8. The idea being that environmental quality and social equity are as important as economic stability and growth is:

a. Sustainable development
b. Triple Bottom Line
c. Business strategy
d. Sustainable business practices
e. I do not know

Section II: The following questions ask about your Sustainable Behavior & Attitude

9. How important was sustainability to you prior to attending CSU?
Not Important 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 – 10 *Very Important*

11. How important is sustainability to you now as a CSU student?
Not Important 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 – 10 *Very Important*

12. As a student, how important is it to you to make an effort to reduce energy consumption?
Not Important 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 – 10 *Very Important*

13. As a student on campus, how important is it to you to make an effort to reduce water usage?
Not Important 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 – 10 *Very Important*

14. As a student, how important is it to you to make an effort to recycle?
Not Important 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 – 10 *Very Important*

15. How often do you use a refillable water bottle on campus?
Never, Rarely, Sometimes, Often

16. How would you rate your level of involvement in CSU environmental sustainable activities?
No Involvement 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 – 10 *High Involvement*

17. Environmental sustainability is important to CSU?
Not Important 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 – 10 *Very Important*

Section III: The following questions ask about your interest in advocacy on campus:

18. Please indicate if you would support the following campus initiatives:

Add more sustainability messages around campus
Yes/No
Bike share
Yes/No
Ban use of plastic bags for purchases made on campus
Yes/No
Carpooling program
Yes/No
Extra fee for single-use coffee cups sold on campus

Yes/No

Fewer bottled beverages sold on campus

Yes/No

Free sustainability education seminars

Yes/No

Hire a CSU Sustainability Coordinator

Yes/No

Increase service learning and volunteer opportunities related to sustainability

Yes/No

More sustainability related courses offered

Yes/No

More use of solar power energy production

Yes/No

Readily available campus composting

Yes/No

Other _____ (please share your idea)

Section IV: The following questions are about you:

19. Please indicate your current academic level:
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. Graduate Student/ Professional/Vet Med Student
    f. Other _____

20. Are you an international student?
    a. Yes
    b. No

21. Please describe your racial or ethnic background:

    _____

22. Please provide your year of birth: _____

23. Please select how you identify:
    a. Female
    b. Male
    c. Transgender
    d. Prefer not to disclose

24. Do you live on campus?
    a. Yes
    b. No

25. Please indicate your major or area of study at CSU:

_____

26. After completing this survey do you have any questions or comments?

_____

APPENDIX D: PHASE ONE CSU INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE:	December 16, 2015
TO:	Makela, Carole, Education Kamberelis, George, Education, Harmon, Renee, Education
FROM:	Swiss, Evelyn, Coordinator, CSU IRB 2
PROTOCOL TITLE:	Examining Student Knowledge of Sustainability in Higher Education
FUNDING SOURCE:	NONE
PROTOCOL NUMBER:	15-6211H
APPROVAL PERIOD:	Approval Date: December 16, 2015 Expiration Date: December 15, 2016

The CSU Institutional Review Board (IRB) for the protection of human subjects has reviewed the protocol entitled: Examining Student Knowledge of Sustainability in Higher Education . The project has been approved for the procedures and subjects described in the protocol. This protocol must be reviewed for renewal on a yearly basis for as long as the research remains active. Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

Important Reminder: If you will consent your participants with a signed consent document, it is your responsibility to use the consent form that has been finalized and uploaded into the consent section of eProtocol by the IRB coordinators. Failure to use the finalized consent form available to you in eProtocol is a reportable protocol violation.

If approval did not accompany a proposal when it was submitted to a sponsor, it is the PI's responsibility to provide the sponsor with the approval notice.

This approval is issued under Colorado State University's Federal Wide Assurance 00000647 with the Office for Human Research Protections (OHRP). If you have any questions regarding your obligations under CSU's Assurance, please do not hesitate to contact us.

Please direct any questions about the

IRB's actions on this project to: IRB

Office - (970) 491-1553;

RICRO_IRB@mail.Colostate.edu
Evelyn Swiss, Senior IRB Coordinator - (970) 491-1381; Evelyn.Swiss@Colostate.edu
Tammy Felton-Noyle, Assistant IRB Coordinator - (970) 491-1655; Tammy.Felton-Noyle@Colostate.edu

Swiss, Evelyn
Approval to recruit 3, 500 students with the approved recruitment and consent materials. Because of the nature of this research, it will not be necessary to obtain a signed consent form. Documented consent is waived under § _ _.116 (d).

Approval Period:	December 16, 2015 through December 15, 2016
Review Type:	EXPEDITED
IRB Number:	00000202

APPENDIX E: PHASE TWO CSU INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

Colorado State University

Research Integrity & Compliance Review Office
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX (970) 491-2293

Date: November 30, 2016

To: Carole Makela, Ph.D., Professor, School of Education
Renee Harmon, Doctoral Student, School of Education

From: IRB Coordinator, Research Integrity & Compliance Review Office
(RICRO_IRB@mail.colostate.edu)

Re: Examining Students' Perspectives of Sustainability Using the Concepts of the Triple Bottom Line

Funding: None

IRB ID: 274 -17H Review Date: November 30, 2016
This project is valid from three years from the review date.

The Institutional Review Board (IRB) Coordinator has reviewed this project and has declared the study exempt from the requirements of the human subject protections regulations with conditions as described above and as described in 45 CFR 46.101(b):

Category 2 - Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

The IRB determination of exemption means that:

- This project is valid for three years from the initial review. After the three years, the file will be closed and no further research should be conducted. If the research needs to continue, please let the IRB Coordinator know before the end of the three years. You do not need to submit an application for annual continuing review.
- You must carry out the research as proposed in the Exempt application, including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- Any modification of this research should be submitted to the IRB through an email to the IRB Coordinator, prior to implementing any changes, to determine if the project still meets the Federal criteria for exemption.
- Please notify the IRB Coordinator (RICRO_IRB@mail.colostate.edu) if any problems or complaints of the research occur.

Please note that you must submit all research involving human participants for review by the IRB. Only the IRB or designee may make the determination of exemption, even if you conduct a similar study in the future.

APPENDIX F: EMAIL INVITATION TO PARTICIPATE IN CSU 2016 SLA

Dear Student,

You have been selected to participate in the Colorado State University Sustainability Survey. By clicking on the following link you will access the survey and consent form, which provides further information about the survey:

<link>

Thank you,

Tonie Miyamoto
Director of Communications and Sustainability
Housing and Dining Services
Tonie.miyamoto@colostate.edu

APPENDIX G: CSU 2016 SLA CONSENT FORM

Dear Participant,

My name is Renée Harmon and I am a researcher from Colorado State University in the School of Education. We are conducting a research study on sustainability education at CSU. The title of our project is Examining Student Knowledge of Sustainability in Higher Education. The Principal Investigator is Carole Makela, School of Education and I am the Co-Principal Investigator.

We would like you to take an online survey. Participation will take approximately 10-15 minutes. Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participation at any time without penalty.
We will not collect your name or personal identifiers, however at the end of the survey we will ask if you are interested to participate in future interviews or focus groups. If you select yes for future participation, then we will be collecting your name and contact information. When we report and share the data to others, we will combine the data from all participants. We will keep your data confidential; your name and data will be kept separately in password protected folders on a password protected computer accessible only to the research team. While there are no direct benefits to you, we hope to gain more knowledge on the current state of sustainability education at CSU.

There are no known risks for participation in this study. It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential (but unknown) risks.

To indicate your willingness to participate in this research and to continue on to the survey, click here: <link>.

If you have any questions about the research, please contact Renée Harmon at rharmon1@rams.colostate.edu. If you have any questions about your rights as a volunteer in this research, contact the CSU IRB at: RICRO_IRB@mail.colostate.edu; 970-491-1553.

Carole Makela, Ph.D. Renée Harmon

APPENDIX H: REMINDER EMAILS FOR CSU 2016 SLA

First Email Sent March 10, 2016 after initial invitation.

Dear Student:

Your assistance is needed; will you help us out?

Your name has been selected to participate in the CSU Sustainability Survey. Only a select group of undergraduate and graduate students have been asked to participate, so your response is very important.

This survey should take approximately 10-15 minutes to complete. Your participation is voluntary and your responses will be kept completely confidential. Your responses will be combined with all other data for statistical analysis. The results of the survey will be used to assist Colorado State University in its sustainability efforts and to gain an understanding of your perspectives regarding the sustainability at CSU.

To participate in this study: Please click on the survey link:

<link>

Completion of the survey by March 22nd is greatly appreciated.

Please direct any questions concerning the actual survey to:

Toni Miyamoto
toni.miyamoto@colostate.edu

Second Email Sent March 21, 2016 after initial invitation.

Dear Student,

As a reminder, if you have not had a chance to participate in the Colorado State University Sustainability Survey, to is the last day! Please respond by 5:00PM this evening. By clicking the following link below you will access the survey and consent form, which provides further information about the survey:

<link>

Thank you!

Tonie Miyamoto
tonie.miyamoto@colostate.edu

APPENDIX I: FOCUS GROUP INVITATION

Greetings,

You are receiving this email because you participated in the CSU 2016 Sustainability Survey. My name is Renée Harmon and I am a CSU PhD candidate in the School of Education and I developed the survey as part of my dissertation research. I am currently analyzing the results of the survey. My analysis involves gaining insights from CSU students on the topics included in the survey.

You are invited to participate in a 1-hour focus group to discuss topics of sustainability. Catered food, coffee & tea will be provided in exchange for your time. The focus group will be limited to a maximum of 10 students.

The focus group meeting should take approximately one-hour to complete and will take place at the School of Global Environmental Sustainability (Johnson Hall Rm. 108). Your participation is voluntary and your responses will be kept confidential. The results of the focus group will be used to assist in revising a sustainability literacy assessment (the survey).

You may select one of the following choices to participate in a focus group:

Choice 1:
Friday February 10, 2017
11 a.m. - 12 p.m.

Choice 2:
Monday February 13, 2017
2 p.m. - 3 p.m.

Choice 3:
Tuesday February 21, 2017
4 p.m. - 5 p.m.

Choice 4:
Tuesday March 7, 2017
11 a.m. - 12 p.m.

To participate in one of the focus groups, please reply to this email with your selected choice for date/time. As a reminder, each focus group meeting is limited to 10 students so please RSVP soon! Please feel free to email me with any questions.

Thank you,
Renée Harmon, PhD candidate
School of Education

APPENDIX J: SNOWBALL SAMPLING EMAIL INVITATION FOR FOCUS GROUP

Greetings,

Your input is wanted! My name is Renée Harmon and I am a CSU PhD candidate in the School of Education and I developed a sustainability literacy assessment (SLA) that was used at CSU in 2016. The SLA is part of my dissertation research, and my analysis involves gaining insights from CSU students on the topics included on the assessment.

You are invited to participate in a 1-hour focus group to discuss topics of sustainability. Catered food, coffee & tea will be provided in exchange for your time. The focus group will be limited to a maximum of 10 students.

The focus group meeting should take approximately one-hour to complete and will take place at the School of Global Environmental Sustainability (Johnson Hall Rm. 108). Your participation is voluntary and your responses will be kept confidential. The results of the focus group will be used to assist in revising the SLA.

You may select one of the following choices to participate in a focus group:

Choice 1:
Friday February 10, 2017
11 a.m. - 12 p.m.

Choice 2:
Monday February 13, 2017
2 p.m. - 3 p.m.

Choice 3:
Tuesday February 21, 2017
4 p.m. - 5 p.m.

Choice 4:
Tuesday March 7, 2017
11 a.m. - 12 p.m.

To participate in one of the focus groups, please email renee.harmon@colostate.edu with your selected choice for date/time. As a reminder, each focus group meeting is limited to 10 students so please RSVP soon! Please feel free to email me with any questions. You are also welcome to share this invite with other CSU students.

Thank you,
Renée Harmon, PhD candidate
School of Education

APPENDIX K: CODES DEVELOPED FROM FOCUS GROUP PARTICIPATION RESPONSES

jobs
stability
reckless spending
micro loans
savings plan
sustainable renewable
income
for-profits and non-profits engaged in charitable work
reliability
budget
taxes
income & expenses
reducing carbon footprint
energy
sustainable farming
development
climate change
global warming
population growth
resource use
peak oil
recycling
wildlife protection
clean water
emissions
balance
oil spills
hydrogen & nutrient cycles
fracking
ecosystem services
community based
community engagement
bigger picture
community cohesion
social inclusivity
hierchy
group effort
laws
liability
access to resources
community centers
maintenance
education
water rights
strategic planning
courtesy
reduce
green
economics
lifestyle
reuse
environmental
renewable energy
waste
responsibility
power investment
fair trade
economic stability
development
cooperation
affluence
public health
poverty
ethics
justice
human health
community development
access to influence
community
impact of energy
reciprocity
education of women
political stability
equality
carbon emissions
zero waste
social impact
eco-system
habitat conservation
purchase power
conservation
self sufficiency
population
investment
planning
methane emissions
low impact
ocean health
everything
regulation
income equality
electric transportation
loan programs
renewables
restoration
certification programs
market access
natural capital
consumer power
eco-friendly
renewable electricity
restriction of growth
species diversity less consumption
water consumption
resource access
wildlife habitat
adaptability
socio-ecological systems
food
water quality
air quality
land tenure
urban design
consumption impact
clothing
energy efficiency reduction
mixed zoning
water conservation
social norms

public transportation
local regulation
mixed zoning
resource allocation
consumption
indoor space reduction
regulations
zoning laws
resource management
construction
energy efficiency
subsidy
resource pooling
environmental laws
responsible business
global
no factory farms
smart regulation
opportunity
globalization
world market
dead zone
efficiency
water usage
wise use
growth
behavior change
distance
cost
sustainable growth
carbon tax
water reuse
land use
renewable resources
watershed
renewable energies
future generations
organic farming
carbon neutral
climate
steady economics
ozone depletion
high performance housing
ozone
animal protection
independence
net zero energy
pesticide use
flora
soil
ecological change
water
organism
local farms
social stats
NGO
socio-ecological
revolution
caste
cultural education
compromise
equal opportunity
collaboration
someone to care
acceptance
diversity
rights
living organisms
water use
global scale
organic
greenhouse gases

APPENDIX L: COLORADO STATE UNIVERSITY 2017 SUSTAINABILITY LITERACY ASSESSMENT

Start here:

1. Using the scale below rate your perceived knowledge of sustainability. Select one number.

1 represents low knowledge of sustainability and 10 represents high knowledge of sustainability.

1– 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10

Select the one best response for each question.

Sustainability:

2. Which is the most commonly used definition of sustainability:
   c. Creating a government welfare system that ensures universal access to education, healthcare, and social services
   d. Setting aside resources for preservation, never to be used
   e. *Meeting the needs of the present without compromising the ability of future generations to meet their own needs*
   f. Building a neighborhood that is both socio-demographically and economically diverse
   g. I do not know

3. Environmental quality and social equity are as important as economic stability; this is called:
   h. Sustainable development
   i. Acceptable business strategy
   j. Decision making for sustainable living
   k. Triple bottom line
   l. I do not know

Environmental sustainability:

4. The term "carbon footprint" is a measure of:
   a. The size of the carbon chain in a given quantity of gasoline
   b. Toxic carbons released in the air
   c. Greenhouse gases released by burning fossil fuels
   d. Carbon created by human footprints
   e. I do not know

5. Ground level ozone (bad ozone) is most often caused by:
    a. *Emissions from industrial facilities and motor vehicle exhaust*
    b. Chemicals from aerosol and other spray cans
    c. Methane gases from landfills and cattle exhaust
    d. Air traffic exhaust
    e. I do not know

6. The Life Cycle Assessment is a tool that evaluates the:
    a. Age of a society
    b. Environmental impact of a product or service system from conception to end of use
    c. Damage a product might have on the environment
    d. Changes in human life expectancy
    e. I do not know

7. Carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons are all:
    a. Atmospheric gases
    b. Gases produced by humans
    c. Gases important to control global warming
    d. Greenhouse gases
    e. I do not know

8. The majority of endangered species are at risk due to:
    a. Overhunting of exotic animals for their tusks, horns, etc. in their natural habitats
    b. Human activities, natural habitat loss, climate change, and the introduction of non-native species to ecosystems
    c. Issues with inbreeding due to people wanting purebred pets
    d. Disease and illness not adequately controlled
    e. I do not know

9. What does ozone protect humans from:
    a. Asteroids and other space matter
    b. Skin cancer
    c. Overheating of the Earth
    d. Harmful ultraviolet rays
    e. I do not know

10. Which best describes stormwater:
    a. Rain and snowmelt flowing over land, accumulating pollutants
    b. Storm waste
    c. Acid rain
    d. Water collected from rain storms that people are allowed to keep for their personal use
    e. I do not know

11. The organization that oversees environmental regulations:
    a. *Environmental Protection Agency (EPA)*
    b. The White House
    c. State governments
    d. Federal Pollution Control (FPC)
    e. I do not know

12. Climate change creates:
    a. Nicer weather in cold locations
    b. Human illnesses
    c. Conflict between humans
    d. *Loss of habitats*
    e. I do not know

Economic sustainability:

13. Which of the following is a general definition of economic sustainability:
    a. Sustaining the current state of the country's economy
    b. *Ability to support a defined level of economic production indefinitely*
    c. The idea that everyone should earn a middle-class income
    d. Continued profit growth
    e. I do not know

14. Is there a wage gap in the U.S. between women and men:
    a. *Yes*
    b. No
    c. I do not know

15. Which law restricts the employment and abuse of child workers:
    a. Fair Labor and Work Act (FLWA)
    b. *Fair Labor Standards Act (FLSA)*
    c. Equal Opportunity Employment (EOE)
    d. Child Worker Protection Act (CWPA)
    e. I do not know

16. Which most accurately describes "living wage" in a given location:
    a. Minimum wage to support one's cost of living
    b. *Hourly wage that, at a minimum, supports a standard of living above the poverty level*
    c. Minimum wage a person can be paid
    d. Hourly wage paid based upon a person's qualifications
    e. I do not know

17. Most minimum wage workers are employed in which industry:
    a. Childcare
    b. Customer Service/Telemarketing

c. *Food Service*
d. Manufacturing
e. I do not know

18. What is the most accurate definition of economic inequality:
    a. *Difference found in various measures of economic well-being among individuals in a group, among groups in a population or among countries*
    b. Similarities found in various measures of economic well-being among individuals in a group, among groups in a population or among countries
    c. Wage gap examples
    d. Difference found in wage earnings between people of different cultural backgrounds
    e. I do not know

19. What is minimum wage:
    a. an amount of money that is the least amount of money per hour that workers must be paid according to the law
    b. Wage for incoming new employees that is the least amount of money per hour that they must be paid in the starting position
    c. Starting salary expectations
    d. Wage for working in retail or fast-food
    e. I do not know

20. What does the Equal Pay Pact of 1963 do:
    a. Provides protection to men to earn equal wages as women
    b. Allows sex-based wage discrimination between men and women in the same establishment who perform jobs that require substantially equal skill, effort and responsibility under similar working conditions
    c. Protected women from sex-based wage discrimination up until 1963
    d. *Prohibits sex-based wage discrimination between men and women in the same establishment who perform jobs that require substantially equal skill, effort and responsibility under similar working conditions*
    e. I do not know

21. What is the most accurate definition of income disparity:
    a. The difference between the incomes of men and women
    b. *The difference between the incomes of the richer and poorer parts of society*
    c. The difference between the incomes of people of different ages
    d. The difference between the wealth of the government and its people
    e. I do not know

Social sustainability:

22. Victims of labor trafficking often work in which industry:
    a. Dance shows, musical shows, carnivals
    b. Escort services, dating services

c. *Agriculture, domestic work, health and beauty services*
d. Construction, car sales, yard work
e. I do not know

23. What is a "food desert":
    a. *Urban or rural areas without ready access to fresh, healthy, and affordable food.*
    b. Area where food is not grown due to climate, therefore all food must be shipped in
    c. Food that has been deemed unacceptable for human consumption
    d. A large compost bin
    e. I do not know

24. In the U.S., K-12 public school students who do not speak English have the right to:
    a. Be taught only in their native language
    b. Request the use of a mentor or tutor
    c. There are no specific rights for non-English speakers
    d. *Be taught English and provided with bilingual instruction*
    e. I do not know

25. Half of all U.S. undergraduate students attend:
    a. *Community Colleges*
    b. Public State Universities
    c. Private Colleges
    d. Online Universities
    e. I do not know

26. The U.S. Department of Health and Human Services describes medically underserved areas/populations where:
    a. There are no hospitals for people to gain access to major surgeries
    b. Care is expensive to tax payers
    c. *Too few primary care providers, high infant mortality, high poverty*
    d. Outdated medical equipment is used
    e. I do not know

27. What is an accurate statement about food security in the U.S.:
    a. Food security is not an issue
    b. *African American households are more than twice as likely to be food insecure as white, non-Hispanic households*
    c. This is an issue that affects those that live in rural areas that have dry, hot climates
    d. Elderly, homeless, and members of the LGBT population are twice as likely to be food insecure as other Americans
    e. I do not know

28. What does the Matthew Shepard Act do?

a. *Outlaws hate crimes based on both sexual orientation and gender identity*
b. Protects people from hate crimes based on sexual orientation and gender identity
c. Protects teenagers and at-risk youth
d. Outlaws discrimination based on both sexual orientation and gender identity
e. I do not know

29. What does the Office of Fair Housing and Equal Opportunity do?
a. Protects people from being evicted from their home based on their religion, race, or sex
b. Protects people from being removed from their home for non-payment due to economic hardship
c. Protects people from discrimination on the basis of race, color, religion, sex, national origin, disability, and familial status
d. Protects people from living in undesirable living conditions
e. I do not know

30. Which is the most accurate definition of social sustainability:
a. The stability of a community at protecting its people and its investments
b. Considers how individuals, communities and societies live with each other
c. Considers how individuals are treated based on their cultural background
d. The stability of a community over time
e. I do not know